

# Review of ecology and nomenclature of fungi (Basidiomycota) reported under the Algerian cedar forests (*Cedrus atlantica* Mentti Carries) with the occurrence of new orthographical variants for fungal repositories

LOUNIS YUCEF KHODJA<sup>\*,1,2</sup>

1. Laboratoire de recherche en écologie et en environnement, Faculté des sciences de la nature et de la vie, Université de Béjaïa-06000, Béjaïa, Algérie
  2. Department of Plant Biology and Ecology, University of Sétif 1, Algérie
- \* Corresponding author: lounisyoucefkhodja@yahoo.fr

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## Abstract

This paper attempts to update available data on basidiomycota, reported from or known to occur under Algerian cedar forests, obtained from 46 publications issued between 1846-2020. This review is based on the Shenzhen Code (2017), several recent molecular studies, and comparative descriptions of taxa. A total of 43 species names are reported with anomalies in their nomenclatures. Four names are excluded from the inventory of fungal species in Algerian cedar forests, of which three are invalid. Five names are updated, of which three have false synonyms. Two names, already abandoned as species of Algerian cedar forests, must be retained in the fungal species checklist for these forests. Five new records are inserted as valid orthographical variants in the fungal

repositories. Additionally 27 names have orthographical, typographical and hyphens errors. The reasons for excluding names and false synonyms are given. Based on in-depth studies and rules of International Code of Nomenclature of algae, fungi and plants (Shenzhen Code), nomenclatural anomalies are corrected for each species name. The ecological status of some species is discussed, which might change the chorological knowledge of those species.

## Introduction

Mycology, the study of fungi, is an important branch of the life sciences (Carlile *et al.* 2001). It evolved like other biological sciences with the evolution of chemical, microscopic and molecular investigative methods. Indeed, the evolution of mycology began

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with the publication of Carl Linnaeus species *plantarum* (1<sup>st</sup> ed. ) in 1753 (May *et al.* 2019). Mycology has its own language and classification codes from the early 19th century, influenced by the work of Persoon (1801) (*Synopsis methodica fungorum*) and of Fries (1821, 1832) (*Systema mycologicum*). The incorporation of molecular characters in mycology has changed the current approach to fungal classification by creating large groups formed from several independent evolutionary lineages (Selosse & Durieu 2013). As a legacy of the history of mycology, the fungal taxonomy is regulated by the International Code of Botanical Nomenclature (ICBN), renamed International Code of Nomenclature of algae, fungi and plants (ICNafp) (Shenzhen Code) (Turland *et al.* 2018) after updating the Melbourne Code (2011) by adding Chapter F (Fungi) for names of organisms treated as fungi (May *et al.* 2019).

Algerian mycota studies began in 19th century with interest of European naturalists (Durieu de Maisonneuve 1846; Patouillard 1887, 1897, 1902, 1903, 1905, 1906, 1920; Maire 1906, 1910a, b, 1913, 1914, 1916, 1917, 1927a, b, 1928; Battandier *et al.* 1914; Malençon 1952; Malençon & Bertault 1970, 1975; Dorleans 1972; Lanier 1994). These early inventories have become foundational supports for more recent inventories carried out in various Algerian ecosystems (Nezzar-Hocine *et al.* 1996, 1998; Djelloul *et al.* 2010; Youcef Khodja 2010, 2021; Djelloul 2014; Benazza-Bouregba *et al.* 2016; Benfriha *et al.* 2020; Youcef Khodja *et al.* 2020; Souna *et al.* 2023).

However, many of fungal names in these inventories are outdated, containing nomenclatural anomalies like invalid names (*nomen nudum*), confused name (*nomen confusum*), false synonyms, and orthographical, typographical and hyphens errors. Additionally, inventories of Algerian macro-fungal flora of remain limited, with the main studies conducted in the national park cedar (Youcef Khodja *et al.* 2020): National Park of Belezma (Patouillard 1902, 1903; Maire 1914; Bensaci *et al.* 2015); National Park of Thenièt El Had (Maire 1914); National Park of Chrèa (Battandier *et al.* 1914; Maire 1914, 1927a; Dorleans 1972; Youcef Khodja 2010); and National Park of Djurdjura (Maire 1916; Lanier 1994; Nezzar-Hocine *et al.* 1996, 1998).

The aim of this work is to revise and update the names of Basidiomycota fungal species

occurring in Algerian cedar forests, based mainly on the Shenzhen Code (2017), recent molecular studies and comparative studies. This can be considered a small portion of a more comprehensive work needed to update the mycological flora of Algeria and insert the correct names into the Algerian fungal checklist. This work can resolve ambiguities in certain names and synonyms reported not only in the Algerian but also international literature. This review is similar to other rare studies utilizing the Shenzhen Code to update mycological inventories in countries worldwide (Richter *et al.* 2019; Boekhout *et al.* 2022; Liu *et al.* 2022).

## Materials & methods

### Data sources

The data used in this study were obtained from mycological research conducted between 1846 and 2020. We focused on basidiomycetous fungi found in the cedar forests of Algeria. The Algerian forests, located in national parks, are represented by specific acronyms for each locality (Figure 1). The georeferenced coordinates (latitude and longitude) for each locality were obtained from the relevant publications.

### Abbreviations of localities

“**PNB**”: National Park of Belezma in the Aurès massif (N 35° 34' E 6° 01')

“**PNBT**”: National Park of Babor-Tababort in the Babors massif (N 36° 45' E 5° 4')

“**PNC**”: National Park of Chrèa in the Blidéen Atlas (N 36° 28' E 2° 49')

“**PND**”: National Park of Djurdjura in the Djurdjura massif (N 36° 45' E 4° 22')

“**PNTH**”: National Park of Thenièt El Had in the Ouarsenis massif (N 35° 52' E 2° 0')

### Data processing

The update of species names and their authors reported in the literature (1846-2020) was performed using three global fungal name registration repositories recognized by the Nomenclature Committee for Fungi (NCF) and International Mycological Congress (IMC) (Wang *et al.* 2022): Fungal names

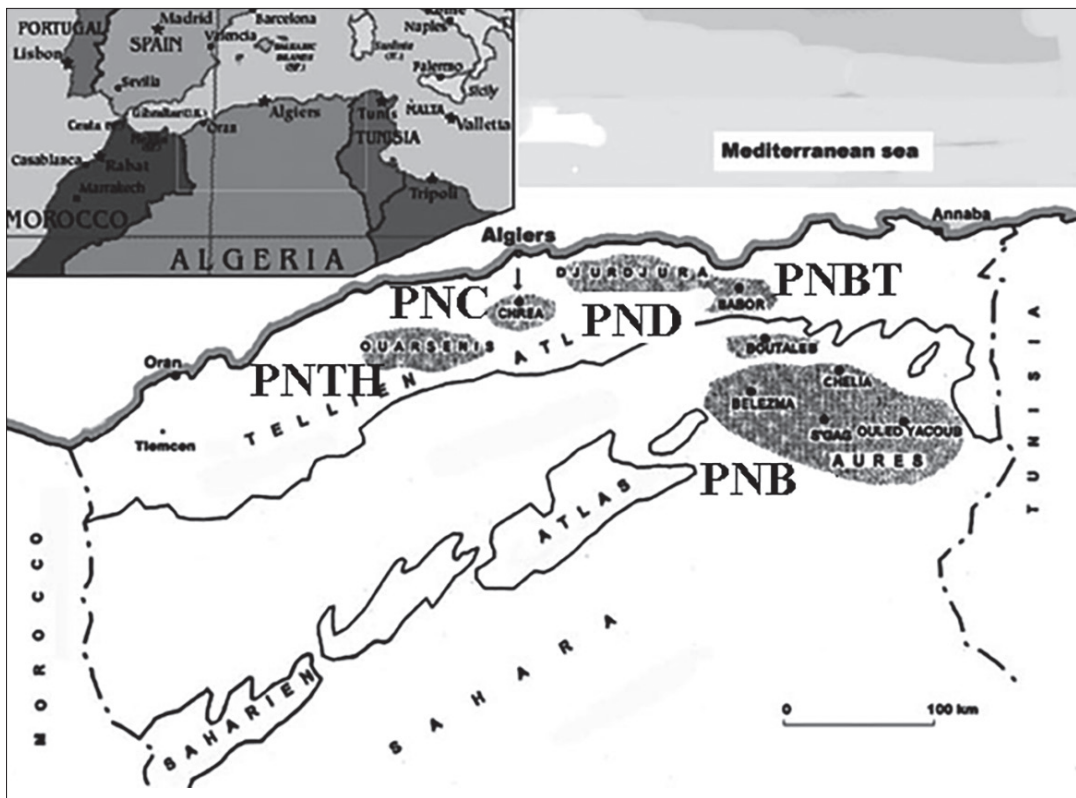


Figure 1 – General map of North Algeria with the location of the cedar forests. National Park of: Belezma (PNB); Boabor-Tababort (PNBT); Chrèa (PNC); Djurdjura (PND); Theniè El Had (PNTH).

(FN, <https://nmdc.cn/fungalnames/>), Index Fungorum (IF, <http://indexfungorum.org/Index.htm>) and MycoBank (MB, <https://www.mycobank.org/>). Names that not be found in database are marked with a \*. Invalid names are marked with a ⊗. Synonyms of certain reported species were considered based to their diagnoses or their princeps diagnosis, taking into account morphological, microscopic characters and ecological information. Uncertain information provided by authors is followed by a (?). All errors, including spelling, typographical and hyphens errors were corrected in accordance with the International Code of Nomenclature of algae, fungi and plants (Shenzhen Code), ICNafp: <https://www.iapt-taxon.org/nomen/main.php> (Turland *et al.* 2018). Nomenclatural abbreviations used in this paper are taken from Shenzhen Code.

**ad int.:** ad interim

**Anon.** anonymous: indicating that the author of a publication is unknown

**auct. mult.** *auctorum multorum*: indicating that many subsequent authors used a name in a different sense to the original author.

**nom. confus.** *nomen confusum*: confused name for which the type and/or application

cannot be determined and which therefore is no longer used.

**nom. nov.** *nomen novum*: a new name published as an explicit substitute (avowed substitute) for a legitimate or illegitimate, previously published name, which is its replaced synonym and which, when legitimate, does not provide the final epithet, name, or stem of the replacement name.

**nom. nud.** *nomen nudum*: a designation of a new taxon published without a description or diagnosis or reference to a description.

**nom. rej.** (*nomen rejiciendum*): when a name it was nomen claturally superfluous when published or a later homonym.

**nom. superf.** (*nomen superfluum*): a name that, when published, was applied to a taxon that, as circumscribed by its author, definitely included the type of a name that ought to have been adopted, or of which the epithet ought to have been adopted.

**nom. sanct.** (*nomen sanctionatum*):

**orth. cons.** *Orthographia conservanda*: a name of taxa, declared legitimate, even though it may have been illegitimate when published, and taking precedence over other specified names even if it lacks priority. Or a name for

which the type, orthography, or gender has been fixed by the conservation process.

ss.: sensu of description

ss. orig.: original sensu

Finally, the nomenclature of plant species associated with the fungal flora is given according, on the case, to the African Plant Database (version 3.4.0) 2022 (APD): <https://africanplantdatabase.ch/> and with The Euro+MedPlantBase: <http://ww2.bgbm.org/EuroPlusMed/query.asp>.

## Results and Discussion

In the examination of fungal species nomenclature (Basidiomycota) within Algerian cedar forests (*Cedrus atlantica* (Endl.) Carrière) across 46 publications spanning 1846-2020, 43 names have been identified as misreported. These include: (i) Four (9%) names that have excluded from the inventory, with three of them being invalid [*Hygrophorus russula* (Sch. Fr.) Quél., *Hygrophorus russula* var. *cedretorum*⊗, *Galactinia umbrina*⊗, and *Inocybe largus*⊗]. (ii) Five (11.5%) names, three of which have false synonymies [*Oudemansiella badia*, *Cortinarius amoenolens* and *Ramaria myceliosa*], while two have been updated based on recent studies [*Hebeloma versipelle* (Fr.) Gille and *Russula basifurcata* sensu auct. mult.]. (iii) Two (5%) names, *Cortinarius aurasiacus* Pat. ss. orig. and *Tricholoma caligatum*, previously abandoned as species within Algerian cedar forests, should now reinstated in the fungal species checklist for these forests. The name *Phlegmacium aurasiacus* (Pat.) Maire, a valid combination, can be included in mycological repositories as a synonym of *C. aurasiacus* Pat. ss. orig. (iv) According to the Shenzhen Code, there are five (11.5%)

valid orthographic variants that have been reported in the literature and should be added to prominent fungal repositories. These new valid orthographic variants are *Hygrocybe acutoconica* var. *langei* (Kühner) Bon, *Inocybe geophila* Dufour, *I. piriadora* (Pers.) P. Kummer, *Geaster berkeleyi* Masee, and *G. fimbriatus* Fr. J. (v) Lastly, among the total names, 27 (63%) contain spelling, typographical and hyphens errors (Figure 2).

### Excluded names

Four names of fungal species, as reported by Dorleans (1972) (*Hygrophorus russula* (Sch. Fr.) Quél., *Galactinia umbrina*⊗, *Inocybe largus*⊗), and Nezzar-Hocine *et al.* (1996, 1998) (*Hygrophorus russula* var. *cedretorum*⊗), are excluded from the list of fungal taxa within Algerian cedar forests. Three of these (*G. umbrina*, *I. largus* and *H. russula* var. *cedretorum*) are considered invalid. The reasons for excluding each species are outlined below:

***Hygrophorus russula* (Sch. Fr.) Quél.**  
(nom. sanct.)

Dorleans (1972) reported this species under *Cedrus atlantica* (Endl.) Carrière in Northern Algeria's PNC. However, it has been reported under different host species in various locations. Maire (1933) reported it under *Quercus cerris* L. (*Q. lanuginosa* Lam.) in Spain, while Malençon & Bertault (1975) found it in mixed forest systems with *Cedrus atlantica* and *Quercus ilex* L. in Morocco. Additionally, it has been observed under *Pinus-Quercus* associations in Guatemala (Huang *et al.* 2021). This fungus is considered as a mycorrhizal species and typically grows in the presence of deciduous trees (*Quercus* spp.) mainly *Quercus ilex*. (Gérault 2005b; Roux 2006; Eyssartier & Roux 2011; Courtecuisse & Duhem 2013).

In light of the recent phylogenetic study conducted by Huang *et al.* (2021) on the *Hygrophorus russula* complex across different continents, it has been confirmed that *H. russula* (Sch. Fr.) Quél. is exclusively a mycorrhizal species associated with *Quercus* trees. Therefore, it is suggested that Dorleans (1972) may have misidentified the habitat of this species. It is worth noting that Dorleans (1972) mentioned conducting mycological sampling simultaneously in the transition area (1200 m) between *Q. ilex* and *C. atlantica* in

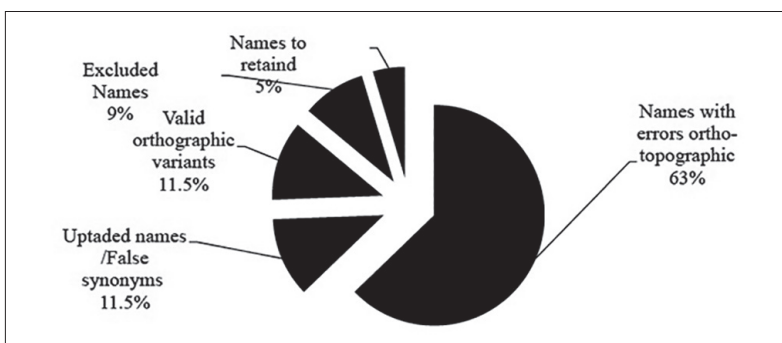


Figure 2 – Repartition of misreported fungal names, as species grows under Algerian cedar forests, in literature (1846-2020).

the PNC region of Northern Algeria. As a result, it is advisable to remove *Hygrophorus russula* (Sch. Fr.) Quél. from the inventory of fungal species within Algerian cedar forests.

***Hygrophorus russula* var. *cedretorum***\*Ⓜnom. nud.

The name of *Hygrophorus russula* var. *cedretorum* Maire was reported solely by Nezzar-Hocine *et al.* (1996, 1998) under *Cedrus atlantica* of Djurdjura (PND). However, this nomenclature does not have any presence or validation in existing literature or mycological repositories. Furthermore, no Latin diagnosis, description or illustration has been provided thus far for the variety “var. *cedretorum*” of the *H. russula* (Sch. Fr.) Quél. (nom. sanct.).

Within the literature, two varieties have been identified for *Hygrophorus russula*. *H.* var. *erubescens* (Fr.) Bat. described by Bataille (1910), and *H.* var. *purpurascens* (Alb. & Schw.) Quél. described by Quélet (1886). Currently, these varieties are considered as separate species, namely *Hygrophorus erubescens* (Fr.) Fr. (with nom. sanct.) and *H. purpurascens* (Alb. & Schw.) Fr. (nom. sanct.) respectively. Based on the provided information and in accordance with Article 39.1 and Recommendation 50B of ICNafp (Turland *et al.* 2018), it can be concluded that *H. russula* var. *cedretorum* is a nomen nudum [*H. russula* var. *cedretorum* nom. nud.]. Consequently, it is an illegitimate name that should be definitively excluded from the list of Algerian fungal species.

Nezzar-Hocine *et al.* (1996, 1998) appear to have encountered confusion between the species *H. russula* (Sch. Fr.) Quél. and the *H. purpurascens* var. *cedretorum* Maire. This confusion may have arisen due to similarities or overlapping characteristics between the two species. G rault (2005a) suggests that there is a possibility of confusing *H. russula* with *H. purpurascens*.

***Galactinia umbrina***\*Ⓜanon. nom. nud.

The name *Galactinia umbrina* reported by Dorleans (1972). The name lacks the author’s name and a proper description, diagnosis, or illustration, making it an invalid and unrecognized name in mycological databases (*G. umbrina* anon. nom. nud.) (Art 46.9 Ex.45) (Turland *et al.* 2018).

The confusion may have arisen from the taxonomic and nomenclatural complexities of the genus *Peziza*, particularly the historical consideration of *Galactinia* as a subgenus of *Peziza* Cooke (Cooke 1879; Boudier 1885). To try to remove this confusion and identify Dorleans’ (1972) collection, three hypotheses can be put forward:

The first hypothesis suggesting that *G. umbrina* anon. nom. nud. could be *Peziza umbrina* Pers., commonly known as *Otidea cochleata* (L.) Fuckel, is not valid. This is because Dorleans (1972) already noted the presence of *Otidea umbrina* anon. in the same inventory, which indicates a different species. Additionally, in Algeria, *P. umbrina* Pers. is reported as *O. umbrina* (Pers.) Bres. specifically under *Quercus suber* L. (Patouillard 1903). Therefore, it is clear that *P. umbrina* Pers. cannot be considered as a valid replacement for *G. umbrina*.

The second hypothesis suggests that *G. umbrina* anon. nom. nud. could be *Peziza umbrina* Boud., which is commonly known as *Peziza echinospora* P. Karst. However, this hypothesis is not valid. *Peziza echinospora* specifically fruits on burned soil, as supported by studies conducted by G ng r *et al.* (2014) and Raudabaugh *et al.* (2020). Since Dorleans (1972) did not provide information about the soil type on which the species grows, it is crucial missing information that renders this hypothesis invalid. Therefore, the name *G. umbrina* Boud. cannot be replaced by *P. echinospora* P. Karst.

The third hypothesis proposes that *G. umbrina* anon. nom. nud. could be *Peziza umbrina* Schumach., also known as *Otidea alutacea* (Pers.) Masee. This species forms symbiotic associations with hardwood trees such as *Quercus* and *Fagus* (Parslow & Spooner 2015; Naseer *et al.* 2019) and is reported by Dennis (1984) under *Quercus suber* in Algeria. This hypothesis can be considered valid if we assume that Dorleans collected the species in the transition area between *Quercus ilex* and *Cedrus atlantica* in the PNC. In this case, the name *G. umbrina* anon. nom. nud. can be replaced with *Otidea alutacea* (Pers.) Masee, and it should be included in the list of fungal species in Algerian oak forests. Therefore, the combination *Galactinia umbrina* should not be included in the list of fungal species within Algerian cedar forests.

***Inocybe largus*** \* ⊗ anon. nom. nud.

Dorleans (1972) reported *Inocybe largus* Fr., but it suffers from two anomalies: a misattribution of authorship (*I. largus* anon.) (Art 46.9 Ex.45) (Turland *et al.* 2018) and a lack of description, diagnosis, or illustration (nomen nudum) (Rec. 50B) of ICNafp. Consequently, the name *Inocybe largus* anon. nom. nud. is not validly published (Art 38.1; Rec. 50B) (Turland *et al.* 2018) and should not be retained in the list of fungal species within cedar forests in Algeria. The only plausible hypothesis is that Dorleans (1972) intended to refer to *Cortinarius largus* Fr., a species already reported in Algeria under oak forests

(*Quercus afares* Pomel, *Q. faginea* Lam., and *Q. suber*) (Maire & Werner 1937; Malençon & Bertault 1970).

### Review of the synonymy of fungal species of Algerian cedar forests

*Oudemansiella badia* (Quél.) Moser: Malençon & Bertault (1975) reported this species in cedar forests in Morocco and Algeria (PNBT and PNC). They provided several synonyms, including *Collybia longipes* (Bull. ex St. Amans) Kummer ss. Bresadola and *C. longipes* var. *badia* Quél., as well as *Marasmius longipes* Konrad et Maublanc.

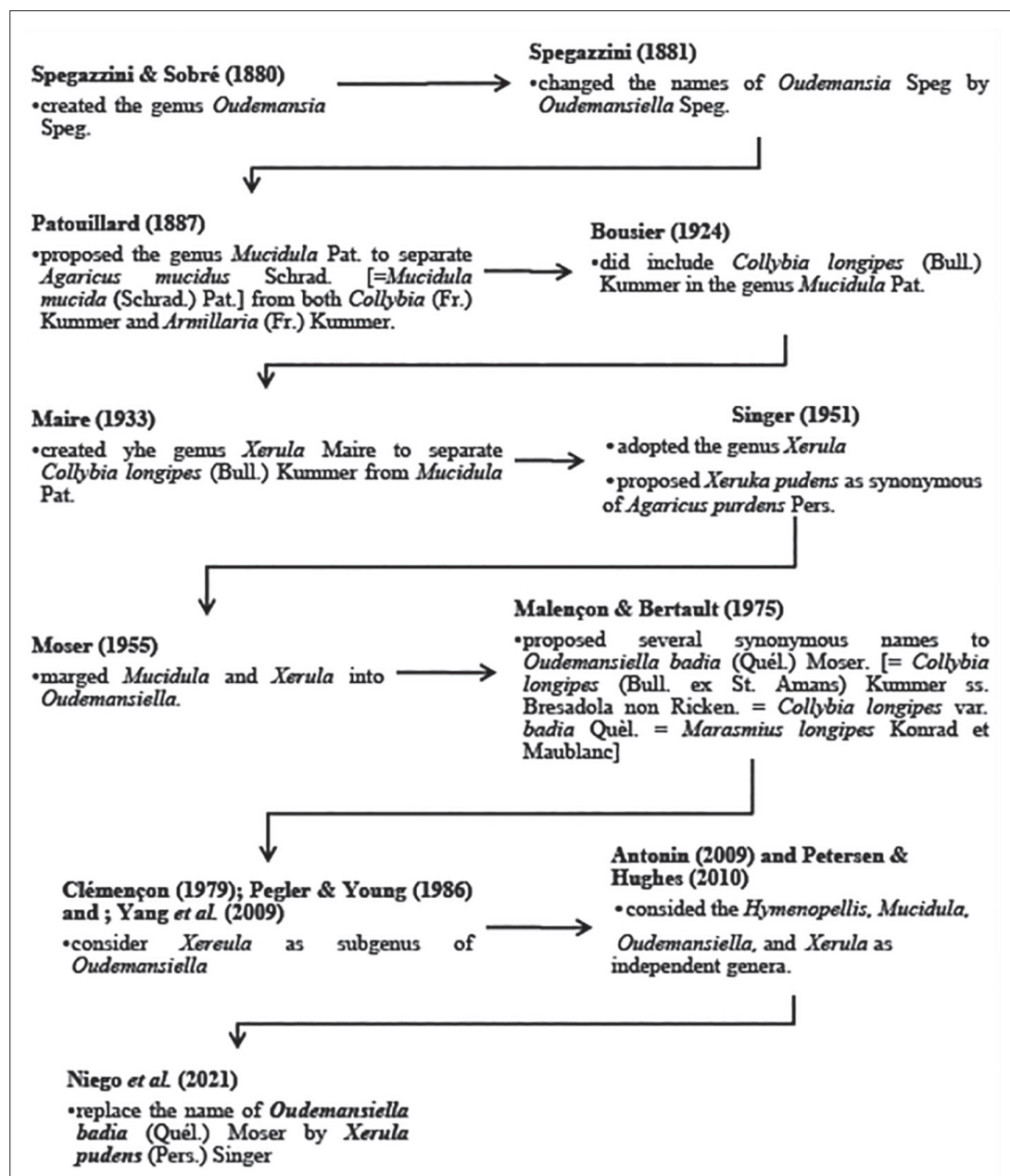


Figure 3 – Taxonomic evolution of *Oudemansiella badia* into *Xerula pudens* (Pers.) Singer in the “*Oudemansiella/Xerula*” complex.

The classification of the *Oudemansiella* *Xerula* complex has been debated extensively by mycologists from 1880 to 2021 (Spegazzini & Sobré 1880; Spegazzini 1881; Patouillard 1887; Boursier 1924; Maire 1933; Singer 1951; Moser 1955; Malençon & Bertault 1975; Cléménçon 1979; Pegler & Young 1986; Antonin 2009; Yang *et al.* 2009; Petersen & Hughes 2010) (Figure 3). After a phylogenetic study, Niego *et al.* (2021) agreed with Petersen & Hughes (2010) and replaced the name *Oudemansiella badia* (Quél.) Moser with *Xerula pudens* (Pers.) Singer.

***Cortinarius amoenolens*** Rob. Henry ex P.D. Orton: Nezzar-Hocine *et al.* (1998) considered this species as a synonym of *C. anserinus* (Velen.) Rob. Henry. However, there has been significant debate regarding the synonymy of the two taxa. . Some authors believed that *C. anserinus* and *C. amoenolens* are synonymous (Gérault 2005a, 2005b; Courtecuisse & Duhem 1994; Vila *et al.* 2008; Tortelli & Kibby 2020), while others treated them as distinct species. After the criticisms of Henry (1996), Courtecuisse & Duhem (2013) doubt to this synonymy. In a revision of the family *Cortinariaceae* classification based on phylogenetic study, Liimatainen *et al.* (2022) did not support this synonymy. A comparison of the descriptions of *C. (Phlegmacium) amoenolens* (Henry 1951; Orton 1960) and *C. anserinus* (*P. anserinum* Velen.) (Velenovský 1920; Henry 1986), revealed differences in cap, cuticle, flesh, margin, gills, stipe, and spore characteristics. These differences can lead to confusion, especially during the development of carpophores, making it challenging to distinguish between these **two species..in** cap, cuticle, flesh, margin, gills, stipe, and spore characteristics and the reaction of the flesh to potassium hydroxide (KOH 5%) (brownish ocher/grayish color).

**Cap:** ochre yellow olivaceous at *C. amoenolens* (Henry 1951), ochraceous yellow with olive hues or olivaceous fawn at *C. anserinus* (Henry 1986).

**Bulb:** attenuated at *Cortinarius amoenolens* (Moser 1952), distinct margin «*bulbodistinctee marginato*» at *C. anserinus* (Velenovský 1920).

**Odor:** weak, pleasant fruity, sometimes very distinct mirabelle plum (Orton 1960; Henry 1996) or odor of *Inocybe bongardii* (Weinm.) Quél. (Henry 1951; Moser 1952) at *C. amoenolens*, while a powerful odor of

roasted goose meat burning at *C. anserinus* (Velenovský 1920; Henry 1986, 1996).

**Spores:** limoniform, (9) 10-13 x 6-7 µm (Orton 1960) at *Cortinarius amoenolens* (Henry 1951; Orton 1960) and amygdaliform, 10-12µm at *C. anserinus* (Velenovský 1920; Henry 1986).

**Tast:** bitter at *C. amoenolens* (Moser 1952; Henry 1996), sweet at *C. anserinus* (Henry 1986).

**Chemical reaction of the flesh to potassium hydroxide (KOH 5%):** negative reaction (Henry 1951; Moser 1952) or positive reaction (brownish ocher color) (Bidaud *et al.* 2005) in *C. amoenolens*, positive reaction (grayish color) in *C. anserinus* (Henry 1986).

Ecology : *Cortinarius amoenolens* was found under conifers (Nezzar-Hocine *et al.* 1998; Hagerman *et al.* 1999) and under broadleaf woods (Orton 1960; Laganà *et al.* 1999, 2002; Bidaud *et al.* 2005; Denchev & Assyov 2010), while *C. anserinus* is exclusively associated with broadleaved trees, particular *Fagus* (*F. sylvatica* L.) (Garnica *et al.* 2003; Dimou *et al.* 2008).

Therefore, *Cortinarius anserinus* (Velen.) Rob. Henry is not a synonym of *C. amoenolens* Rob. The retained name, in the list of fungal species in Algerian cedar forests, is *C. amoenolens* currently known as ***Phlegmacium amoenolens*** (Rob. Henry ex P.D. Orton) Niskanen & Liimat. (Liimatainen *et al.* 2022).

***Ramaria myceliosa*** (Peck) Corner: Initially, Nezzar-Hocine *et al.* (1998) reported this species as synonym to *Clavaria corrugata* P. Karst. While Gérard (2005a) supported this synonymy, subsequent research by Giachini (2004) and Giachini & Castellano (2011) identified them as distinct species. Notably, there are no mycological repositories confirming the synonymy between *Ramaria myceliosa* (Peck) Corner. and *C. corrugata* P. Karst. These species have been named ***Phaeoclavulina myceliosa*** (Peck) Franchi & Marchetti (2018) and ***P. corrugata*** (P. Karst.) Læssøe & Petersen (2018) respectively.

A detailed comparison of the two species' descriptions unequivocally distinguishes them:

***P. myceliosa*** (Peck) Franchi & Marchetti is recognized by five character: (1) open branched basidiocarp, (2) honey yellow coloration, (3) presence of gloeoplerous hyphae in rhizomorphs, (4) spiny spores with short spines (Exeter *et al.* 2006), (5) and by small

spore length (more cylindrical) (Exeter *et al.* 2006; De Angeli 2020). This species can be confused with *P. curta* (Fr.) Giachini, but it is distinguishable by its shorter spores ( $\approx 4.4\mu\text{m}$  long, broadly ellipsoid to short-cylindrical) (Exeter *et al.* 2006), and with *P. ochracea* (Bres.) Giachini (*Ramaria ochracea* (Bres.) Corner) by its ellipsoidal spores (De Angeli 2020). It is typically found under coniferous wood (*Cedrus*, *Picea* and *Pinus*) (Gérault 2005a; Nezzar-Hocine *et al.* 1998; Exeter *et al.* 2006; Senn-Irlet *et al.* 2009; Shiryayev 2009b).

***P. corrugata*** (P. Karst.) Læssøe & Petersen is characterized by branches ranging from light ocher to yellow ocher, but also ocher yellow to banana yellow, with age  $\pm$  usually becoming darker, yellow ocher, ocher to brownish ocher below, sometimes with a tint of orange-ochre or olive- ochre (Karsten 1868; Schild 1975). Spores olive yellow, only immature spores sometimes have a drop. Slightly irregular in shape, partly  $\pm$  almond-shaped and mostly somewhat elongated and tapering at the sides [(5.1)6-9.7(10.4) x (3)3.2-4.8(5.1)  $\mu\text{m}$ ], spines 0.3-1 (1.4)  $\mu\text{m}$  long, strongly cyanophilic. Apiculus 0.3-0.8 (1.1)  $\mu\text{m}$  long, its wall very thin and not or only slightly cyanophilic (Schild 1975). This species primarily grows under *Pinus* (*P. sylvestris* L.) (Karsten 1868) and in the tundra (Shiryayev 2009a).

Given these distinctions, the name ***Phaeoclavulina myceliosa*** (Peck) Franchi & M. Marchetti, formerly known *Ramaria myceliosa* (Peck) Corner, is retained in checklist of fungal species in the Algerian cedar forests as species distinct from *P. corrugata*.

***Hebeloma versipelle*** (Fr.) Gillet:

This species has been reported in the cedar forest of Algeria (PNC, PND and PNTN) by various authors (Maire & Werner 1937; Malençon & Bertault 1970; Nezzar-Hocine *et al.* 1996, 1998). Its interpretations has evolved since its original description (Grilli 2017). The French literature available to these authors, including Maire & Werner (1937), Malençon & Bertault (1970), Nezzar-Hocine *et al.* (1996, 1998), followed Konrad & Maublanc (1924) in applying this name to a *Hebeloma* section species with persistent Cortina. Two interpretations emerged: that of Malençon & Bertault (1970) (*H. versipelle* ss. Konrad & Maublanc), applied to North Africa (Algeria and Morocco) harvests and that of Romagnesi (1965) (*H. versipelle* ss. Romagnesi), renamed *H. subcaespitosum*

Bon. Grilli (2009) initially reported the collection from Morocco by Malençon & Bertault (1970) as *H. subcaespitosum* Bon, which is now considered a synonym of *H. dunense* R. Heim (Grilli 2017).

However, the comprehensive revision of *Hebeloma* from Europe and North Africa published by Beker *et al.* (2016) suggests that the Malençon harvest reviewed by Grilli (2009) corresponds to *H. subtortum* P. Karst. This species has been widely distributed in North Africa's cedar forests, where it was described under various names that were synonymized by Beker *et al.* (2016): *H. pallidum* Malençon, *H. malenconii* Grilli, and *H. sordidum* Maire. Therefore, it is likely that most of the observations previously in the north African cedar forests (Battandier *et al.* 1914; Maire 1914; Maire & Werner 1937; Malençon & Bertault 1970; Nounsi *et al.* 2014; Kedad & Bouznad 2018) under names like *H. pallidum* Malençon, *H. malenconii* Grilli, *H. sordidum* Maire and *H. versipelle* (Fr.) Gillet are related to ***H. subtortum*** P. Karst.

***Russula basifurcata*** sensu auct. mult.: The name *Russula basifurcata*, presented as "*R. basifurcata* sensu auct. mult." without specifying the author's name, was originally identified by Nezzar-Hocine *et al.* (1998) as a synonym for *Russula subterfurcata* (non *subterfurcata*) Romagn. The species *R. basifurcata* was initially described by Peck (1885) as *R. basifurcata* ss. stricto Peck in North America. Subsequently, other specimens were documented in North America under variation of the sensu, including *R. basifurcata* ss. Saccardo (1887a), *R. basifurcata* (as *R. basifurcata* Pk) ss. McIlvaine & Macadam (1912), *R. basifurcata* ss. Burlingham (1915), *R. basifurcata* ss. Beardslee (1918) and *R. basifurcata* ss. Singer (1938)]. These descriptions had slight differences, potentially related to habitat variations (Singer 1938). Additionally, descriptions in northern Europe [*R. basifurcata* ss. (Lange 1938- 1939), *R. basifurcata* ss. Schäffer (1938), *R. basifurcata* ss. Kühner & Romagnesi (1953) and *R. basifurcata* ss. Blum (1962)].

Comparing the original description by Peck (1885) with descriptions of American harvests, it becomes evident that the American descriptions closely align with Peck's (1885) description, except for *R. basifurcata* ss. Singer, which featured a longer stipe (Singer 1938). In contrast, European descriptions do not match the American descriptions (Table 1).



Table 1– Comparison between the different meanings of *Russula basifurcata sensu auct. mult.*

	Caracteres Species	Color of cap	Taste	Spores	habitat	Current species
American specimens	<i>R. basifurcata</i> Peck	dingy-white, sometimes tinged with yellow or reddish-yellow	taste mild, then bitterish	Spores elliptical, pale yellow	Dry hard ground in paths and wood roads	<i>Russula basifurcata</i> Peck
	<i>R. basifurcata</i> ss Saccardo	white, often yellow to yellow-red ( <i>albido, saepe flavo v. flavo-rufo tincto</i> )	sweet and then bitter taste. ( <i>redulcideinamarulo</i> )	spores elliptic, pale yellow ( <i>sporisellipticis, pallidefiavis</i> )	in the woods and on the roads ( <i>in silvis et ad vias</i> )	
	<i>R. basifurcata</i> ss. McIlvaine & Macadam	dingy-white, sometimes tinged with yellow or reddish-yellow	slight bitterish taste disappears in cooking	Spores elliptical, pale yellow, uninucleate or shining	Dry hard ground in paths and wood roads	
	<i>R. basifurcata</i> ss. Burlingham	dingy-white, often tinged with yellow or reddish-yellow	mild then bitterish	Spores pale-yellow, elliptic	Dry ground in woods and bushy places	
	<i>R. basifurcata</i> ss. Beardslee	white with tints of yellow and rose	taste mild, then slightly bitter and very slightly acrid.	Spores pale yellow, a little darker than Ridgway's maize yellow-round ellipsoid to subglobose	-	
	<i>R. basifurcata</i> ss. Singer	white, slightly yellowish with old age	Mild, slightly bitter, not acrid	Spores ocher pallid, shortly ellipsoidal	Under <i>Pinus ponderosa</i> Douglas ex. Lawson.	
Euroafrican specimens	<i>R. basifurcata</i> ss. Lange; Schäffer	color whitish-pale to light dirt-grayish (tawny reddish spots) Cap with a tinge of light dirt-grayish	Taste in young specimens slightly pungent after prolonged mastication, soon almost tasteless	Small spores oval-spheric, minutely warty spinulose	in a wood of <i>Fagus</i> with old <i>Pinus</i> -trees, on sandy ground.	<i>Russula heterophylla</i> (Fr.) Fr.
	<i>R. basifurcata</i> ss. Kühner-Romagn.	ocher, mixt of purplish gray, olive, bluish green (tawnyreddish spots)	Sub-acrid, sweet a little pungent in the gills	Small, broadly elliptical spores with obtuse warts, spaced apart, slightly cristulate, slightly amyloid	Hardwoods Graminous (beeches)	Romagn.
European (fresh and Spanish) specimens	<i>R. basifurcata</i> ss. Blum.	Earth color, less dark bronze green, then paling becoming yellowish, dirty cream. No purple or pink.	mild and pleasant tast	Spores less round, not latticed, adorned with low spines.	Bare earth under spruces, in the mountains	Bidaud, Moëgne-Locc. & P.-A. Moreau

Notably, Singer (1938) resisted adopting the name *R. basifurcata* Peck (without red fawn spots) and preferred the name *R. basifurcata* ss. Lange and *R. basifurcata* ss. Schäffer (with rufous spots). Lange (1940) highlighted that *R. basifurcata* ss. Lange is a distinct from with a whitish cap tinged with light dirt-gray, making it unmistakable from other *Russula* species.

Kühner & Romagnesi (1953) recommend the nomenclature *Russula basifurcata* ss. Kühner-Romagn. for specimens from North Africa and Northern Europe, contending that *R. basifurcata* ss. Lange; ss. Schäffer corresponds to

a species already reported by Fries (1874) (*R. galochroa* Fr.), now named *R. heterophylla* (Fr.) Fr. According to Adamčík *et al.* (2018), *R. basifurcata* (European species) has a color range and strongly forking lamellae close to the stipe. Consequently, Romagnesi (1967) and Schwöbel (1975) argued that the name *R. basifurcata* ss. Lange; ss. Schäffer should not be used for European discoveries, advocating for the use of *R. subterfurcata* instead. The latter can be confused with *R. basifurcata* ss. Lange; ss. Schäffer based an cap color, but they exhibit clear differences in spores characteristics (Kauffman 2007).

Regarding *Russula basifurcata* ss. Blum, described by Blum (1962) in France under spruces trees, attempts have been made to provide it another name. Sarnari (1992) believed he had found Blum's *Russula* under *Fagus* (woodland) in Italy and noted differences between *R. basifurcata* ss. Blum specimens from northern and southern Italy, renaming the later as *R. faustiana* Sarnari characterized by its lighter color (Pál-Fám & Benedek 2022a). A year later, Sarnari (1993) thought he had rediscovered *R. basifurcata* ss. Blum and assigned it the name *R. piceicola* Sarnari, but this name was invalid (Art. 39.1) (Turland *et al.* 2018) due to a lack of a Latin description, diagnosis or reference to one. Finally, Reumaux *et al.* (1996) found specimens of *R. basifurcata* ss. Blum in subalpine France (Savoie) under conifers (*Picea*) and gave them the name *R. montensis* Bidaud, Moëgne-Locc. & P.-A. Moreau.

Hence, the interpretation of *Russula basifurcata* sensu auct. mult., as reported by Nezzar-Hocine *et al.* (1998) under the cedar of PND, aligns with the interpretation of Kühner & Romagnesi (*R. basifurcata* ss. Kühner-Romagn.), which is currently known as *Russula subterfurcata* Romagn. Consequently, the name of *R. basifurcata* Peck, mentioned in various works from North Africa and Europe (Tkalcec & Mesic 2003; El kholfy *et al.* 2011; Nounsi *et al.* 2014; Outcoumit *et al.* 2014; Karadelev *et al.* 2018), should be replaced either *R. montensis* Bidaud, Moëgne-Locc. & P.-A. Moreau, *R. heterophylla* (Fr.) Fr., or *R. subterfurcata* Romagn., all of which closely resemble *R. basifurcata* Peck.

Pending molecular studies of specimens of *R. subterfurcata* Romagn. from North Africa and Europe, its ecology and new distribution are accepted. It has been reported in Northern Europe under beech forests (*Fagus* sp.), spruce forests (*Picea* sp.), and pine forests (*Pinus* sp.) (Derbsch 1992; Courtecuisse & Duhem 2013; Pál-Fám & Benedek 2022a, b), in Moldova under oak (*Quercus* sp.) (Manic 2016) and in Mediterranean Europe, particularly in Turkey under oak forests (*Quercus* sp.) (Kaya & Bag 2010). It is also found under *Cedrus* trees at high altitudes in North Africa (Bertault 1978; Nezzar-Hocine *et al.* 1998).

## Names to maintain (already abandoned)

Malençon & Bertault (1970) and Benazza-Bouregba *et al.* (2016) excluded the names *Cortinarius aurasiacus* Pat. and *Tricholoma caligatum* (Viv.) Ricken respectively from the fungal species list of Algerian cedar forests. These names should be maintained in list as the authors do not provide adequate justification or they give doubtful information to support their arguments. The reasons for retaining these names are discussed below for each species names.

### *Cortinarius aurasiacus* sensu auct. mult.

Two interpretations of *Cortinarius aurasiacus*, presented as *C. aurasiacus* sensu auct. mult., are found in the literature. The first interpretation, as described by Patouillard (1902), is presented as *C. aurasiacus* Pat ss. orig. The second interpretation, as described by Malençon & Bertault (1970), is rendered as *C. aurasiacus* Pat. ss. Malen. & Bert. The species *Cortinarius aurasiacus* Pat. ss. orig. has been collected by Patouillard (1902) in April (spring) under *Quercus ilex* in Sgag, currently PNB (Algeria). subsequently, it was also found by Battandier *et al.* (1914) in May (spring) and by Maire 1914, 1927a) in November (autumn) under *Cedrus atlantica* of PNC. In Morocco, it was found by Maire & Werner (1937) in November under *Cedrus atlantica* of Ifrane, while *C. aurasiacus* ss. Malen. & Bert. is recorded by Malençon & Bertault (1970) in March (spring) under *Cedrus* in the Middle Atlas.

Malençon & Bertault (1970) suggest that the description of *Cortinarius aurasiacus* Pat. ss. orig. provided by Battandier *et al.* (1914) and by Maire (1914, 1927a) is similar to the description of *C. caerulescens* (Schaeff.) Fr. (?) or that of *C. sodagnitus* Rob. Henry (?). They argue that Patouillard (1902) misidentified the ecological context of his harvests (*C. aurasiacus* Pat. ss. orig.) by overlooking the presence of the cedar trees within *Quercetum* (*Q. ilex*) habitat (?). However, these suggestions lack sufficient valid arguments or evidence.

Upon comparing the initial description provided by Patouillard (1902) (*C. aurasiacus* Pat. ss. orig.) with description presented by Malençon & Bertault (1970) (*C. aurasiacus* Pat. ss. Malen. & Bert.), it becomes evident that the primary distinction between these two species primarily lies in the shape and

size of their spores: ovoid (10-12 x 6 µ) for *C. aurasiacus* Pat. ss. orig. and amygdaliform (15.5-13.5 x 6.8-7.3 µ) for *C. aurasiacus* Pat. ss. Malen. & Bert. subsequently, there comes the taste (flavor) of their flesh: it is mild for *C. aurasiacus* Pat. ss. orig., and inspid for *C. aurasiacus* Pat. ss. Malen. & Bert. .

To remove this nomenclatural confusion, two suggestions are valid. The first suggestion, is that presented by Bidaud *et al.* (2005), recommended replacing the name *C. aurasiacus* Pat. ss. Malen. & Bert. with the name *C. malenconii* Bidaud, Moëgne-Locc. & Reumaux. The second suggestion, is that proposed by (Maire 1927a) synonymizing the name *C. aurasiacus* Pat. ss. orig. with the name *Phlegmacium aurasiacus* Pat. However, it is important to note that the name *P. aurasiacus* is not documented in the literature and is not recognized in mycological databases, despite its validity as synonym. This validity is based on the fact that the species *C. aurasiacus* Pat. belongs to the section *Scauri* (Patouillard 1902) and the subgenus *Phlegmacium* (Fries 1821; Gèrault 2005b). Furthermore, it is worth mentioning that *Cortinarius* species belonging to the section *Scauri* and subgenus *Phlegmacium* can be designated as *Phlegmacium* sp (Liimatainen *et al.* 2014, 2017). In accordance with Article 6.11 and Rec. 32A of Shenzhen Code (Turland *et al.*, 2018), the name “*P. aurasiacus* (Pat.) Maire nom. nov.” is a nomen novum proposed by Maire for the species previously known as *C. aurasiacus* Pat. Therefore, this revised nomenclature, which recognizes the species as a nomenclatural synonym of *C. aurasiacus* Pat., can be appropriately included in mycological repositories.

As a result, the species name *Cortinarius aurasiacus* Pat. [= *Phlegmacium aurasiacus* (Pat.) Maire] remains valid for the species found in Algerian cedar and oak forests, unless valid evidence is provided to the contrary. Similarly, the species name *C. aurasiacus* Pat. ss. Malen. & Bert., known as *C. malenconii* Bidaud, Moëgne-Locc. & Reumaux, reported specifically in Algerian cedar forests should also be retained.

***Tricholoma caligatum*** (Viv.) Ricken: This particular species has been reported in Algerian cedar forests (PNC, PND and PNT) by some authors, such as Malençon & Bertault (1975) and Nezzar-Hocine *et al.* (1996, 1998). Previously, it was reported under the name *Armillaria caligata* (Viv.)

Gillet by other authors including Battandier *et al.* (1914), Maire (1914, 1915, 1927a), Dorleans (1972), and Lanier (1994). However, Kytövuori (1988) suggested that the specimens of *T. caligatum* found under *Cedrus atlantica* in North Africa (Algeria, Morocco) might actually be *T. nauseosum* (A. Blytt) Kytövuori (?). Based on this suggestion, Benazza-Bouregba *et al.* (2016) consider *T. caligatum* as a potentially new record from North Africa (?).

Unfortunately, the arguments presented by Kytövuori (1988) and Benazza-Bouregba *et al.* (2016) are not well-founded. Firstly, the Kytövuori's (1988) morphological examination of Moroccan specimens does not allow for a clear distinction between *T. caligatum* and *T. nauseosum*. Moreover, Riva (2009) and El kholfy *et al.* (2011) maintain the species name *T. caligatum* for all specimens found in Moroccan cedar forests. Secondly, the discovery of *T. caligatum* under *Quercus suber* and *Pinus halepensis* Mill. in Oran (Northwest Algeria) by Benazza-Bouregba *et al.* (2016) does not eliminate the possibility of its existence under *C. atlantica*.

Consequently, looking forward to molecular study on the harvests found under North African cedar forests to clear up these doubts, the species name ***Tricholoma caligatum*** (Viv.) Ricken should be maintained in the list of fungal species of Algerian cedar forests.

### New orthographic variants

As per Art. 61.2 (Turland *et al.* 2018), orthographical variants are the various spelling, compounding, and inflectional forms of a name or its final epithet (including typographical errors) when only one nomenclatural type is involved. Only one orthographical variant of any one name is treated as validly published, the form that appears in the original publication (Art. 61.1). Except for the errors reported in Art. 60.1, other spellings are regarded as orthographical variants to be corrected (Art. F.9.1).

In this study, we have identified five new valid orthographic variants that need to be added to the mycological repositories, namely ***Hygrocybe acutoconica* var. *langei*** (Kühner) Bon, ***Inocybe geophila*** (as *geophilla*) Dufour, ***I. piriadora*** (Pers.) P. Kummer, ***Geaster berkeleyi*** Masee, and ***G. fimbriatus*** Fr.

***Hygrocybe acutoconica*** (as ***acutoconicus***) var. ***langei***\* (Kühner) Bon

Nezzar-Hocine *et al.* (1998) reported this name as a variety discovered in the cedar forest of Djurdjura (PND), but it has not been documented in fungal repositories or in the existing fungal literature. In the literature, the species name *H. acutoconica* (Clem.) Singer is mentioned with six different varieties, namely: *H. acutoconica* var. *acutoconica* (Singer 1951), *H. acutoconica* var. *aurantiolutescens* (Migliozzi & Camboni 2001), *H. acutoconica* var. *cuspidata* (Arnolds 1985), *H. acutoconica* var. *konradii* (Boertmann 2010), *H. acutoconica* var. *microspora* (Cantrell & Lodge 2000) and *H. acutoconica* var. *pallidocarnea* (Becerra & Robles 2012).

Based on the presence of clamps and the gelatinized stipitipellis, Singer & Kuthan (1976) distinguish *Hygrocybe persistens* (Britzelm.) Singer from *H. acutoconica* (Clem.) Singer. Subsequently, Arnolds (1986) synonymizes these two species names because clamps are consistently present in 4-spored forms of typical *H. acutoconica*, which exhibit a dry to slightly greasy stipe, and the stipitipellis is a cutis. Additionally, *H. persistens* var. *langei* (Kühner) Bon is considered a synonym of *H. acutoconica* (Clem.) Singer (Arnolds 1986; Bon 1988).

Therefore, the name ***Hygrocybe acutoconica*** var. ***langei*** (Kühner) Bon [Basionym: *H. langei* Kühner] may be a valid combination and should be included as a variety of *H. acutoconica* (Clem.) Singer in mycological repositories.

***Inocybe geophila***\* var. ***liliacea*** (***lilacea***) (Fr. ex Sowerby) Quél: This nomenclature mentioned by Dorleans (1972) refers to a fungal variety found in the cedar forest of Blida (PNC). It should be noted that the spelling of the variety “var. *liliacea*,” is a typographical error according to Art 60.1 (Turland *et al.* 2018). The correct spelling should be “var. ***lilacina***”.

However, the name *Inocybe geophila* (or *geophilla*) is not recognized in the repositories of mycological databases such as Index Fungorum and MycoBank. In the literature, the names *Inocybe geophila* and *I. geophylla* are reported by several authors. The name *I. geophila* is rarely cited (Dufour 1881; Costantin & Dufour 1904; Costantin 1933; Gassibe *et al.* 2011; Vergara *et al.* 2011). On the other hand, the name *I. geophylla* (Sowerby)

P. Kummer is widely used in fungal inventories of Algeria, including Battandier *et al.* (1914), Maire (1914), Malençon & Bertault (1970), and Nezzar-Hocine *et al.* (1998). It is also mentioned in various international studies (Gillet 1874; Saccardo 1887b; Ricken 1915; Kauffman 1918; Kühner & Romagnesi 1953; Bollinger & Eugster 1971; Huijsman 1974; Kuyper 1986; Bizio 2009; Eyssartier & Roux 2011; Flores Arzú *et al.* 2012; Courtecuisse & Duhem 2013; Fan *et al.* 2013; Matheny & Swenie 2018).

The dual naming (*I. geophila*/*I. geophylla*) was raised by Léon Marie Dufour during a session of the Mycological Society of France (May 6, 1920) with the only explanation provided by Schrcell (Patouillard 1920). It's about two descriptions for the color of the gills of the same *Inocybe* (Costantin & Dufour 1904; Ricken 1915); such as pallid lilac or reddish gills for *I. geophila* (Costantin & Dufour 1904) and clay-colored gills (tonblau, schl. Grauerdfarbig) for *I. geophylla* (ErdblätterigerFaserkopf) (Ricken 1915).

According to the articles Art. 14, 61.1, and 61.2, as well as the recommendation (Rec. 50E) of the Schenhen Code, the name *I. geophila* (as *geophilla*) is considered an orthographic variant of *I. geophylla* P. Kummer and should be included in the databases. Therefore, it is proposed as orthographia conservanda “*I. geophila* (Fr. ex Sowerby) Quél. orth. cons. [*I. geophylla* P. Kummer]”. Within the meaning of the articles Art. 14, 61.1 and 61.2 and the recommendation (Rec. 50E) of Schenhen Code, the name ***I. geophila*** (as ***geophilla***) is an orthographic variant of *I. geophylla* P. Kummer which must be entered into the databases. Thus, it can be proposed as orthographia conservanda “*I. geophila* (Fr. ex Sowerby) Quél. orth. cons. [*I. geophylla* P. Kummer]”.

***Inocybe piriodora***\* (Pers.) P. Kummer orth. cons.

*Inocybe piriodora* (Pers.: Fr.) P. Kummer is a name that was documented by Dorleans (1972) as a species discovered in the cedar forest of PNC (Blida). It is noteworthy that this name has been referenced in various publications, including Costantin & Dufour (1904), Gilbert (1932), Maire & Politis (1940), List & Freund (1966), Mazza (1998), Dimou *et al.* (2008), and Bizio (2009). However, it is currently not present in mycological repositories.

Despite its absence from the repositories, Bon (1997) considers *I. piriodora* as a conserved spelling (orthographia conservanda, orth. cons.). In accordance with the recommendation (Rec. 50E), *I. piriodora* can be regarded as a valid name and may be included in the repositories as an orthographic variant of *I. pyriodora* (Pers.) P. Kummer (nom. sanct.), which represents the original orthography used by Kummer in 1871. The basionym for this species is *Agaricus pyriodorus* Pers., as described by Persoon in 1801.

### **Geaster/Geastrum**

Two orthographical variants should be included in the repositories: *Geaster fimbriatus* and *Geaster berkeleyi*. These variants correspond to *Geastrum fimbriatum* Fr. and *Geastrum berkeleyi* Masee, respectively.

The genus *Geaster* Fr. (Fries 1829) and *Geastrum* Pers. (Persoon 1794, 1801) are similar names for the same genus (Demoulin 1984; Turland *et al.* 2018) and they are treated as orthographical variants despite the fact that they are derived from two different nouns with the same meaning, i.e. star, aster (asteris) and astrum (astri) (Turland *et al.* 2018) and with the same prefix geo, meaning earth. The replacement of the genus *Geaster* by the genus *Geastrum* was made during the ICBN congress in 1981.

### ***Geaster fimbriatus*\* (Fries 1829) (nom. sanc.)**

*Geaster fimbriatus* (Fries 1829) is a name that was reported by Dorleans (1972) as a species found in the cedar forest of PNC. However, it is not recognized in prominent repositories such as Index Fungorum and Mycobank. The name *Geaster fimbriatus* was originally created by Fries (1821) in the Systema Mycologicum of which gives it a sanctioned name (*G. fimbriatus* Fr. (nom. Sanc.)) according the Art. F. 3 of the Shenzhen Code.

While its mainly found in older references like Milne Edwards (1842), Maire (1902), and Lloyd (1905), more recent works refer to the name *Geastrum fimbriatum* Fr., such as Ellis & Ellis (1990), States (1990), May *et al.* (2003), Roody (2003), Eyssartier & Roux (2011), and O'Reilly (2020).

It's important to note that *Geaster fimbriatus* Tul. & C. Tul., *Geaster fimbriatum* Tul. & C. Tul., and *Geastrum fimbriatum* Tul. & C. Tul. are considered illegitimate names according to Art. 53.1 and Art. F.3.3 (Turland *et al.*, 2018) because they later became

recognized as homonyms of *Geastrum fimbriatum* Fr. in the Mycobank database [MB#528049].

According to Article 61.5 and 62.1 of Shenzhen Code, the name *Geaster fimbriatus* Fr. should be considered an orthographic variant of *Geastrum fimbriatum* Fr. As such, it is necessary to include *Geaster fimbriatus* in the mycological repositories.

### ***Geaster berkeleyi*\* Masee**

*Geaster berkeleyi* as reported by Battandier *et al.* (1914); Maire (1927a), and Lanier (1994), is a species in the Chr ea cedar forest (PNC). However, this species name is not currently recognized in mycological repositories. *Geaster berkeleyi* was originally described by Masee (1889) in a monograph of the British Gastromycetes from Great Britain. It is less mentioned in the literature, with Saccardo (1891), Lloyd (1905), Battandier *et al.* (1914), Velenovsk y (1920), Maire (1927b), Lanier (1994), and Hluza (1999). On the other hand, the name *Geastrum berkeleyi* Masee is recognized in mycological repositories and widely reported in the literature, including works Kotlaba & Pouzar (1987), Demoulin (1989), Kasuya *et al.* (2009), Hemmes & Desjardin (2011), Jeppson *et al.* (2013), and Poumarat (2017).

In accordance with Art. 61.5 and Art. 62.1 of Shenzhen Code (Turland *et al.* (2018), the name *Geaster berkeleyi* Masee should be treated as a orthographic variant of *Geastrum berkeleyi* Masee, and it should be included in the mycological repositories.

## **Orthographic and typographic errors**

In accordance with Art. 60.1 (Turland *et al.* 2018), the spelling correction of fungal species (epithets of fungal names) concerns: (1) typographical or orthographical errors and the standardizations; (2) letters and ligatures foreign to classical Latin; (3) interchange between *u/v*, *il/j*, or *eulev*; (4) diacritical signs and ligatures; (5) terminations; (6) intentional latinizations; (7) compounding forms; (8) hyphens; (10) apostrophes and full stops, and (11) abbreviations.

Of the 43 taxa misreported in this work, 27 taxa contain anomalies in their spellings (bold underlined) including 12 orthographic errors, 6 typographical errors, 4 ortho-typographical errors and 5. hyphen errors (Table 2). Such errors should be corrected.

**Table 2 – Anomalies of fungal species names found under cedar forests of Algeria  
Article (Art.); Recommendation (Rec.).**

Wrong nomenclatures	reporters	Nomenclatures corrected according to Shenzhen Code (Turland et al. 2018)
<b>Orthographic errors</b>		
<i>Coriola versicolor</i>	Dorleans (1972)	<i>Coriolus versicolor</i> (L.) Quél. (Art 60.1) whose current name <i>Trametes versicolor</i> (L.) Lloyd.
<i>Collybia drophila</i> (Bull. ex Fr.) Quél.	Dorleans (1972)	<i>Collybia dryophila</i> (Bull.) P. Kummer (Art. 60.1) whose current name <i>Gymnopus dryophilus</i> (Bull.) Murrill
<i>Hydrocybe duracinus</i>	Maire (1927)	<i>Hydrocybe duracina</i> (Fr.) Ricken (Art. 60.1) whose current name <i>Cortinariu sduracinus</i> Fr.
<i>Entoloma asprelus</i>	Dorleans (1972)	<i>Entoloma asprellum</i> (Fr.) Fayod (Art. 60.1) not <i>Entoloma asprellum</i> ss. G. Stev., illegitimate name (nomensuperfluum) (Art. 52.1 et Art. 53.1) (Segedin & Pennycook 2001)
<i>Entoloma clipeatum</i> (L. ex Fr.) Quél.	Dorleans (1972)	<i>Entoloma clypeatum</i> (L.) P. Kummer (Art 60.1)
<i>Hygrocybe acutoconicus</i>		<i>H. acutoconica</i> (Clem.) Singer (Art. 60.1)
<i>Hymenogaster Klotzschii</i> Tul. & C. Tul.	Dorleans (1972)	<i>Hymenogaster klotzschii</i> Tul. & C. Tul. (Art. 60.8), illegitimate nomenclature (nomensuperfluum) (Art. 52.1). <i>Hymenangium album</i> Klotzsch. (Dietrich et al. 1839) or <i>Rhizopogon albus</i> ss. Berkeley (Smith & Berkeley 1836) (Art. 60.1) whose current name <i>Descolea alba</i> (Klotzsch) Kuhar, Nouhra & ME Sm.
<i>Inocybe castaneus</i> Fr. ex. Bull.	Dorleans (1972)	<i>Inocybe castanea</i> Peck. (Rec 50D) (Art 60.1). The nomenclature <i>Inocybecastanea</i> Velenovsky is illegitimate (later homonym) (Art 53.1)
<i>Neournula pouchetti</i>	Nezzar-Hocine (1998)	<i>Neournula pouchetii</i> (Berthet & Rioussset) Paden (Art 60.1), (Rec 50D)
<i>Psalliota silvatica</i>	Dorleans (1972) ; Lanier (1994)	<i>Psalliota sylvatica</i> (Schaeff.) P. Kummer. whose current name <i>Agaricus sylvaticus</i> Schaeff.
<i>Russula sublaevispora</i>	Nezzar-Hocine et al. (1998)	<i>Russula sublevispora</i> (Romagn.) Kühner & Romagn. (Art 60.1) (Rec 50D)
<i>Russula subterfucata</i>	Nezzar-Hocine et al. (1998)	<i>Russula subterfucata</i> Romagn. (Rec. 50D)
<i>Stropharia aeruginea</i>	Dorleans (1972)	<i>Stropharia aeruginosa</i> (Curtis) Quél. (Art 60.1) (Rec. 50D)
<b>Typographical errors</b>		
<i>Geaster Berkeleyi</i> Masee	(Battandier et al. 1914; Maire 1927a; Lanier 1994)	<i>Geaster berkeleyi</i> (Art 60.1)
<i>Hygrophorus Reai</i>	Maire (1914)	<i>Hygrophorus reae</i> Maire (Art. 60.1) (Rec 60F.1) whose current name <i>Hygrocybe mucronella</i> (Fr.) P. Karst.
<i>Phellinus Hartigii</i>	Patouillard (1903) et par Maire (1914),	<i>Phellinus hartigii</i> (Allesch. & Schnabl) Pat. (Art. 60.1) (Rec 60F.1)
<i>Marasmius hudsoni</i>	Battandier et al. (1914)	<i>Marasmiushudsonii</i> (Art. 60.1) (Rec 60F.1)
<i>Tricholoma Georgii</i> (Schaeff) K et Romgn.	Dorleans (1972)	<i>Tricholoma georgii</i> (L.) Quél. (Art. 60.1) whose current name <i>Calocybegeorgii</i> (L.) Kühner ex Kalamees
<i>Sepularia Sumneriana</i>	Battandier et al. (1914), Maire (1914), Lanier (1994) et Nezzar-Hocine et al. (1996),	<i>Sepularia sumneriana</i> (Art. 60.1) (Rec 60F.1) whose current name <i>Geopora sumneriana</i> (Cooke) M. Torre.
<b>Erreurs ortho-typographiques</b>		
<i>Gautiera Trabutii</i> Pat.	(Maire & Werner 1937)	The generic name <i>Gautiera</i> , contains the orthographic error, corrected on <i>Gautieria</i> Vittad. (Art. 60.1). The names of the epithets ( <i>Trabutii</i> et <i>Trabuti</i> ), contains the typographical errors, corrected on <i>trabutii</i> (Rec. 60C.1b et Rec 60F.1) The corrected nomenclature is <i>Gautieria trabutii</i> (Chatin) Pat.
<i>Gautiera Trabuti</i>	(Battandier et al. 1914; Maire 1914),	
<i>Gautieria Trabuti</i>	(Patouillard 1897)	
<i>Hymenogaster Trabuti</i> Chat.	(Chatin 1891)	
<b>Hyphens</b>		
<i>Ramaria ochraceo-virens</i>	Maire & Werner (1937),	<i>Ramaria ochraceovirens</i> (Art. 60.1) whose current name <i>Phaeoclavulina abietina</i> (Pers.) Giachini
<i>Panus violaceo-fulvus</i>	Battandier et al. (1914) et Maire (1914)	<i>Panellus violaceofulvus</i> (Fr.) Singer (Art. 60.11)
<i>Mycena flavo-alba</i>	Malençon & Beltaut (1975), Maire (1927) et Maire (1914)	<i>Mycena flavoalba</i> whose current name <i>Atheniella flavoalba</i> (Fr.) Redhead (Art. 60.11)
<i>Mycena luteo-alba</i>	Maire (1914),	<i>Mycena luteoalba</i> whose current name <i>Mycena luteoalba</i> (Bolton) Gray
<i>Tricholoma albo-brunneum</i>	Dorleans (1972)	<i>Tricholoma albobrunneum</i> (Pers.) P. Kummer

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## References

- Adamčík, S., Jančovičová, S. & Buyck, B. (2018). The Russulas Described by Charles Horton Peck. *Cryptogamie Mycol*, 39, 3-108.
- Antonin, V. (2009). Revision of *Myxomphalia*, *Delicatula*, *Oudemansiella*, *Xeromphalina*, *Marasmius*, *Collybia* and *Baeospora* in Morocco. In: *Compléments à la flore des champignons supérieurs du Maroc de G. Malençon et R. Bertault*. Confédération européenne de mycologie méditerranéenne, p. 531-546.
- Arnolds, E. (1985). Notes on *Hygrophorus*-IV. New species and new combinations in Hygrophoraceae. *Persoonia*, 12, 475-478.
- Arnolds, E. (1986). Notes on *Hygrophorus*-VIII. Taxonomic and nomenclatural notes on some taxa of *Hygrocybe*. *Persoonia*, 13, 137-160.
- Bataille, F. (1910). Flore monographique des Hygrophores. *Mém Soc ému Doubs*, 8, 132-189.
- Battandier, J.-A., Maire, R. & Trabut, L. (1914). Rapport sur les herborisations faites par la société pendant la session d'Alger. *B Soc Bot Fr*, 61, 37-103.
- Beardslee, H.C. (1918). The Russulas of North Carolina. *Journal of the Elisha Mitchell Scientific Society*, 33, 147-199.
- Becerra, M. & Robles, E. (2012). Contribución al catálogo micológico de la zona gaditana del Parque Nacional de Doñana (Andalucía, España). *Bol. Soc. Micol. Madrid*, 36, 129-142.
- Beker, H.J., Eberhardt, U. & Vesterholt, J. (2016). *Hebeloma* (Fr.) P. Kummer. *Fungi Europei*. Edizioni Tecnografica, Italy.
- Benazza-Bouregba, M., Savoie, J.-M., Fortas, Z. & Billette, C. (2016). A new record of *Tricholoma caligatum* (Tricholomataceae) from North Africa with a discussion of related species. *Phytotaxa-Magnolia Press*, 282, 119-128.
- Benfriha, A., Belhoucine Guezouli, L., Boughalem, M., Tefiani, C., Barka, F., Maazouz, S., et al. (2020). First record, phylogenetic analysis, and key to *Lactarius mediterraneensis* (Russulales, Basidiomycota) and its related species in Tlemcen's national park (Algeria). *Revue Agrobiologia*, 10, 2076-2087.
- Bensaci, O.A., Harzallah, D. & Gouaref, K. (2015). Endophytic mycoflora of *Cedrus atlantica*: diversity patterns and determinism of the phytosanitary situation of Atlas cedar forests in Belezma massif (Algeria). *Forest Science and Technology*, 11, 36-43.
- Bertault, R. (1978). Russules du Maroc. *Bulletin de la Société Mycologique, France*, 94, 5-31.
- Bidaud, A., Moëne-Loccoz, P. & Reumaux, P. (2005). Pièges de la Mimésis. *Cortinarius anserinus* contre *C. amoenolens*. *Bulletin trimestriel de la Fédération mycologique et botanique Dauphiné-Savoie*, 45, 5-12.
- Bizio, E. (2009). Revisione critica del genere *Inocybe* (*Cervicolores*, *Lactiferae*, *Cortinatae*, *Marginatae*). In: *Compléments à la flore des champignons supérieurs du Maroc de G. Malençon et R. Bertault*. Confédération européenne de mycologie méditerranéenne, pp. 205-224.
- Blum, J. (1962). *Les Russules*. Flore Monographique des Russules de la France et des Pays Voisins. Lechevalier, Paris.
- Boekhout, T., Amend, A.S., El Baidouri, F., Gabaldón, T., Geml, J., Mittelbach, M., et al. (2022). Trends in yeast diversity discovery. *Fungal Divers*, 114, 491-537.
- Bollinger, H. & Eugster, C.H. (1971). Nachweis von (+)-epi-Muscarin in *Inocybe geophylla*. 36. Mitteilung über Muscarin und verwandte Stoffe. *Helvetica Chimica Acta*, 54, 1332-1335.
- Bon, M. (1988). *Flore mycologique d'Europe: Hygrophoraceae*. Documents mycologiques: Mémoire hors série 1. Association d'Ecologie et de Mycologie, Amiens.
- Bon, M. (1997). *Clé monographique du genre Inocybe (1<sup>ère</sup> partie : généralités et espèces acystidées = Ss.-g. Inosperma)*. Documents mycologiques. Mémoire. hors-Série. Association d'écologie et de mycologie, Lille.
- Boudier, E. (1885). Nouvelle classification naturelle des Discomycètes charnus connus généralement sous le nom de pezizes. *Société mycologique de France*, 91-120.
- Boursier, M. (1924). Note sur le genre *Mucidula* Pat. *Bulletin de la Société Mycologique de France*, 40, 332-333.
- Burlingham, G.S. (1915). *Russula* Pers. (Agaricaceae). *North American Flora*, 9, 201-236.
- Cantrell, S.A. & Lodge, D.J. (2000). Hygrophoraceae of the Greater Antilles: *Hygrocybe* subgenus *Hygrocybe*. *Mycol Res*, 104, 873-878.
- Carlile, M.J., Watkinson, S.C. & Gooday, G.W. (2001). *The fungi*. 2nd ed. Academic Press, British.
- Chatin, M.A. (1891). Contribution à l'histoire Naturelle de la Truffe. *B Soc Bot Fr*, 38, 54-64.
- Clémengon, H. (1979). Taxonomic Structure of the Genus *Oudemansiella* (Agaricales). *Sydowia*, 32, 74-80.
- Cooke, M.C. (1879). *Mycographia, seu icones fungorum, Figures of fungi from all parts of the world. Discomycetes, pt.1*. Williams and Norgate, UK.

- Costantin, J. (1933). *Atlas des Champignons comestibles et vénéneux*. Frédérique Patat, France.
- Costantin, M.M.J. & Dufour, L.M. (1904). *Nouvelle flore des champignons : pour la détermination facile de toutes les espèces de France et de la plupart des espèces européennes avec 4 265 figures*. Paul Dupont. Librerie Classique et Administrative, Paris.
- Courtecuisse, R. & Duhem, B. (1994). *Guide des champignons de France et d'Europe*. Les guides du naturaliste. Delachaux et Niestlé, Lausanne.
- Courtecuisse, R. & Duhem, B. (2013). *Champignons de France et d'Europe*. Delachaux et Niestlé, France.
- De Angeli, A. (2020). Tre Ramarie poco comuni e interessanti e due raccolte del genere *Phaeoclavulina*. *Micologia nelle Marche*, IV, 15-25.
- Demoulin, V. (1984). Typification of *Geastrum* Pers.: Pers. and Its Orthographic Variant *Geaster* (gasteromycetes). *Taxon*, 33, 498-501.
- Demoulin, V. (1989). Establishing a check-list of Macromycetes: the european Gasteromycetes. *AN Jardin Bot Madrid*, 46, 155-160.
- Denchev, C.M. & Assyov, B. (2010). Checklist of the larger basidiomycetes in Bulgaria. *Mycotaxon*, 111, 279-282.
- Dennis, R.W.G. (1984). Some Ascomycetes from the Maghrib, North Africa. *Kew Bull*, 39, 759-770.
- Derbsch, H. (1992). Die Blätter-und Röhrenpilzflora des Völklinger Kreuzberggebietes. *Zeitschrift für Mykologie*, 58, 85.
- Dietrich, A., Klotzsch, F. & Ochmigke, L. (1839). *Flora regni Borussici*. Verlag von Ludwig Ochmigke.
- Dimou, D., Zervakis, G., Polemis, E. & Gr, D. (2008). Mycodiversity studies in selected ecosystems of Greece: 4. Macrofungi from *Abies cephalonica* forests and other intermixed tree species (Oxya Mt., central Greece). *Mycotaxon*, 104, 39-42.
- Djelloul, R. (2014). Cartographie des champignons au niveau du Parc National d'El Kala (Nord Est Algérien). Thèse Doctorat. Université Badji Mokhtar – Annaba, Algérie.
- Djelloul, R., Samraoui, B. & Sellami, N.L. (2010). Inventory and distribution of higher fungi (macrofungi) at the bog Ain Khia (El Kala National Park, north east of Algeria). *Annals of Biological Research*, 1, 95-105.
- Dorleans, G. (1972). Étude mycologique - Région De Chréa. *Annales de l'Institut national agronomique El Harrach*, 7, 27-42.
- Dufour, L.M. (1881). *Notes mycologiques*. Available at: [https://viagallica.com/fl\\_champignons\\_-\\_planches\\_dufour/champignons\\_-\\_planche\\_dufour\\_040.htm](https://viagallica.com/fl_champignons_-_planches_dufour/champignons_-_planche_dufour_040.htm). Last accessed 19 August 2022.
- Durieu de Maisonneuve, M. (1846). *Exploration scientifique de l'Algérie : pendant les années 1840, 1841, 1842*. Imprimerie royale, Paris.
- El kholfy, S., Aït Aguil, F., Ouazzani Touhami, A., Benkirane, R. & Douira, A. (2011). Bibliographic inventory of Moroccan Rif's fungi: Catalog of rifain fungal flora. *J Anim Plant Sci*, 12, 1493-1526.
- Ellis, M.B. & Ellis, J.P. (1990). *Fungi Without Gills (Hymenomycetes and Gasteromycetes): An Identification Handbook*. Springer Science & Business Media, USA.
- Exeter, R.L., Norvell, L. & Cázares, E. (2006). *Ramaria of the Pacific Northwestern United States*. Salem District, Oregon (USA).
- Eyssartier, G. & Roux, P. (2011). *Le guide des champignons- France et Europe*. Belin, Paris.
- Fan, Y.-G. , Bau, T. & Kobayashi, T. (2013). Newly recorded species of *Inocybe* collected from Liaoning and Inner Mongolia. *Mycosystema*, 32, 302-308.
- Flores Arzú, R., Miettinen, O. & Rinaldi, A.C. (2012). A preliminary checklist of macrofungi of Guatemala, with notes on edibility and traditional knowledge. *Mycosphere*, 3, 1.
- Franchi, P. & Marchetti, M. (2018). Nomenclatural novelties. *Index Fungorum* n°373, 1.
- Fries, E.M. (1821). *Systema mycologicum : sistens fungorum ordines, genera et species, huc usque cognitatas, quas ad normam methodi naturalis determinavit*. Ex Officina Berlingiana, Lundae.
- Fries, E.M. (1829). *Systema mycologicum : sistens fungorum ordines, genera et species, huc usque cognitatas, quas ad normam methodi naturalis determinavit*. Ex Officina Berlingiana, Lundae.
- Fries, E.M. (1832). *Systematis mycologici, sectio posterior, hyphomycetes et coniomycetes continens*. Ernestus Mauritius.
- Fries, E.M. (1874). *Hymenomycetes Europaei sive epicriseos systematis mycologici*. editio altera. /Scripsit Elias Fries, Uppsalia.
- Garnica, S., Weiß, M., Oertel, B. & Oberwinkler, F. (2003). Phylogenetic relationships of European *Phlegmacium* species ( *Cortinari* , Agaricales). *Mycologia*, 95, 1155-1170.
- Gassibe, P.V., Fabero, R.F., Hernández-Rodríguez, M., Oria-de-Rueda, J.A. & Martín-Pinto, P. (2011). Fungal community succession following wildfire in a Mediterranean vegetation type dominated by *Pinus pinaster* in Northwest Spain. *Forest Ecol Manag*, 262, 655-662.
- Gérault, A. (2005a). Florule évolutive des Basidiomycotina du Finistere-Homobasidiomycetes.
- Gérault, A. (2005b). Florule évolutive des Basidiomycotina du Finistère-Homobasidiomycetes-Cortinariales.
- Giachini, A. (2004). *Systematics, phylogeny, and ecology of Gomphus sensu lato*. Oregon State University, USA.
- Giachini, A.J. & Castellano, M.A. (2011). A new taxonomic classification for species in *Gomphus sensu lato*. *Mycotaxon*, 115, 183-201.
- Gilbert, E.J. (1932). Osmologie mycologique. *Bulletin trimestriel de la Société mycologique de France*, 48, 241-252.
- Gillet, C.-C. (1874). *Les hyménomycètes, ou escription de tous les champignons (fungi) qui croissent en France, avec l'indication de leurs propriétés utiles ou vénéneuses*. Ch Thomas. Alençon.
- Grilli, E. (2009). Revisione del genere *Hebeloma*. In: *Compléments à la flore des champignons supérieurs du Maroc de G. Malençon et R. Bertault*. Confédération européenne de mycologie méditerranéenne, pp. 299-318.
- Grilli, E. (2017). Studies on the genus *Hebeloma*, What is *H. versipelle* s. Bresadola? *Rivista Micologica Romana, Bollettino dell'Associazione Micologica Ecologica Romana*, 33, 39-50.
- Güngör, H., Solak, M., Alli, H., Işiloğlu, M. & Kalmiş, E. (2014). New Macrofungi records to the Turkish Mycota. *Biological Diversity and Conservation*, 7, 126-129.
- Hagerman, S.M., Jones, M.D., Bradfield, G.E., Gillespie, M. & Durall, D.M. (1999). Effects of clear-cut logging on the diversity and persistence of



- ectomycorrhizae at a subalpine forest. *Can J Forest Res*, 29, 124-134.
- Hemmes, D.E. & Desjardin, D.E. (2011). Earthstars (Geastrum, Myriostoma) of the Hawaiian Islands Including Two New Species, *Geastrum litchiforme* and *Geastrum reticulatum*. *Pacific Science*, 65, 477-496.
- Henry, R. (1943). Cortinaires nouveaux ou rares de la flore française. *Bulletin Trimestriel de la Société mycologique de France*, 59, 52-60.
- Henry, R. (1951). Les Scauri. *Bulletin Trimestriel de la Société mycologique de France*, 67, 225-322.
- Henry, R. (1986). Suite à l'étude des Cortinaires. *Bulletin Trimestriel de la Société mycologique de France*, 102, 19-96.
- Henry, R. (1996). Notes sur quelques cortinaires rares ou nouveaux. *Documents Mycologiques*, XXVI, 11-17.
- Hluza, B. (1999). The contents and bibliographical index of vol. 1-8 of the Journal Mycologia (Praha) (1924-1931). *Czech Mycology*, 51, 207-270.
- Huang, H.-Y., Zhang, W.-H., Huang, T., Gabriel, M., Liu, T.-Z. & Tang, L.-P. (2021). *Hygrophorus russula* complex (*Hygrophoraceae*, *Agaricales*) in China.
- Huijsman, H.S.C. (1974). Autour de *Inocybe geophylla* (Sow. Per fr.) Kumm.. *B Mens Soc Linn Lyon*, 43, 195-204.
- Jeppson, M., Nilsson, R.H. & Larsson, E. (2013). European earthstars in *Geastraceae* (Geastrales, Phallomycetidae) - a systematic approach using morphology and molecular sequence data. *Syst Biodivers*, 11, 437-465.
- Karadelev, M., Rusevska, K., Kost, G. & Kopanja, D.M. (2018). Checklist of macrofungal species from the phylum Basidiomycota of the Republic of Macedonia. *Acta Musei Macedonici Scientiarum Naturalium*, 21, 23-112.
- Karsten, P.A. (1868). Auriculariei, Clavariiei et Tremellini, in paroecia Tammela creseentes. In: *Notiser ur Sällskapetets pro Fauna et Flora Fennica förhandlingar*. Theodor Sederbolms boktryckeri, pp. 365-374.
- Kasuya, T., Yamamoto, Y., Sakamoto, H., Takehashi, S., Hoshino, T. & Kobayashi, T. (2009). Floristic study of Geastrum in Japan: three new records for Japanese mycobiota and reexamination of the authentic specimen of Geastrum minus reported by Sanshi Imai. *Mycoscience*, 50, 84-93.
- Kauffman, C.H. (1918). *The Agaricaceae of Michigan*. Michigan Geological and Biological, Lansing, Michigan.
- Kauffman, H. (2007). Studier av några Russula-arter ur sektionen Heterophyllae. *Svensk Mykologisk Tidskrift*, 28, 21-69.
- Kaya, A. & Bag, H. (2010). Trace element contents of edible macrofungi growing in Adiyaman, Turkey. *ASIAN J CHEM*, 22, 1515.
- Kedad, A. & Bouznad, Z. (2018). *Catalogue des champignons d'Algérie*. Tarzalt M. Arts graphiques. Algiers-Algeria.
- Konrad, P. & Maublanc, A. (1924). *Icones selectae fungorum*. Paul Lechevalier, Paris.
- Kotlaba, F. & Pouzar, Z. (1987). *Geastrum berkeleyi* v Československu [G.b. in Czechoslovakia]. *Czech Mycology*, 41, 115-119.
- Kühner, R. & Romagnesi, H. (1953). *Flore analytique des champignons supérieurs*. Masson, Paris.
- Kuyper, T. (1986). *A revision of the genus Inocybe in Europe. I. Subgenus Inosperma and the smooth-spored species of subgenus Inocybe*. Rijksherbarium, Leiden, Netherlands.
- Kytövuori, I. (1988). The *Tricholoma caligatum* group in Europe and North Africa. *Karstenia*, 28, 65-77.
- Læssøe, T. & Petersen, JH. (2018). Nomenclatural novelties. *Index Fungorum n°369*, 1.
- Laganà, A., Elena, S., Barluzzi, C., De, V. & Perini, C. (2002). Fungi (macromycetes) in various types of Mediterranean forest ecosystems (Tuscany, Italy). *Polish Botanical Journal*, 47, 143-165.
- Laganà, A., Salerni, E., Barluzzi, C., Perini, C. & Dominicis, V. (1999). Mycocoenological studies in Mediterranean forest ecosystems: calcicolous deciduous oak woods of central-southern Tuscany (Italy). *Czech Scientific Society for Mycology*, 52, 1-16.
- Lange, J.E. (1938- 1939). *Flora agaricina danica*. Recato A/S Copenhagen, Copenhagen.
- Lange, J.E. (1940). *Flora agaricina danica*. Recato A/S Copenhagen, Copenhagen.
- Lanier, L. (1994). Les champignons des cédraies en Algérie (étude comparative). In protection des cédraies. *Annales de Recherche Forestière du Maroc*, 27, 553-563.
- Liimatainen, K., Carteret, X., Dima, B., Kytövuori, I., Bidaud, A., Reumaux, P., et al. (2017). *Cortinarius* section *Bicolores* and section *Saturnini* (Basidiomycota, Agaricales), a morphogenetic overview of European and North American species. *Persoonia*, 39, 175-200.
- Liimatainen, K., Kim, J.T., Pokorny, L., Kirk, P.M., Dentinger, B. & Niskanen, T. (2022). Taming the beast: a revised classification of Cortinariaceae based on genomic data. *Fungal Divers*, 112, 89-170.
- Liimatainen, K., Niskanen, T., Dima, B., Kytövuori, I., Ammirati, J.F. & Frøslev, T.G. (2014). The largest type study of *Agaricales* species to date: bringing identification and nomenclature of *Phlegmacium* (*Cortinarius*) into the DNA era. *Persoonia*, 33, 98-140.
- List, P.H. & Freund, B. (1966). Phenylcrotonaldehyd und andere Aldehyde als Geruchstoffe der Stinkmorchel, *Phallus impudicus* L. *Naturwissenschaften*, 53, 585-585.
- Liu, B., Fu, R., Wu, B., Liu, X. & Xiang, M. (2022). Rock-inhabiting fungi: terminology, diversity, evolution and adaptation mechanisms. *Mycology*, 13, 1-31.
- Lloyd, C.G. (1905). *Index of Mycological Writings*. Library of the University Michigan, USA.
- Maire, R. (1902). Recherches cytologiques et taxonomiques sur les Basidiomycètes. Thèse Doctorat. Paris.
- Maire, R. (1906). Contributions à l'étude de la flore mycologique de l'Afrique du Nord. *B SOC BOT FR*, 53, CLXXX-CCXV.
- Maire, R. (1910a). Les bases de la classification dans le genre *Russula*. *Bulletin de la Société Mycologique de France*, 25, 49-125.
- Maire, R. (1910b). Notes critiques sur quelques champignons récoltés pendant la session de Dijon de la Société Mycologique de France (octobre 1909). *Bulletin de la Société Mycologique de France*, 25, 159-204.
- Maire, R. (1913). Études mycologiques. *Annales Mycologici*, 11, 331-358.

- Maire, R. (1914). La flore mycologique des forêts de cèdres de l'Atlas. *Bulletin de la Société Mycologique de France*, 30, 199-220.
- Maire, R. (1916). Les champignons vénéneux d'Algérie. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du nord*, 7, 131-302.
- Maire, R. (1917). Champignons Nord-Africains nouveaux ou peu connus. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du nord*, 8, 134-200.
- Maire, R. (1927a). Compte-rendu de la session extraordinaire de la Société Mycologique de France, à Alger (novembre 1926). *Bulletin de la Société Mycologique de France*, 43, XVIII-XXXVI.
- Maire, R. (1927b). Excursions mycologiques de la Société d'Histoire Naturelle de l'Afrique du Nord dans la forêt de la Réghaïa les 18 novembre 1923 et 23 novembre 1924. *Bulletin de la Société d'Histoire Naturelle de l'Afrique du nord*, 18, 121-124.
- Maire, R. (1928). Diagnoses de champignons inédits de l'Afrique du Nord. *Bulletin de la Société mycologique de France*, 44, 37-56.
- Maire, R. (1933). *Fungi Catalaunici. Contributions à l'étude de la Flore mycologique de la Catalogne*. Museu De Ciències Naturals, Barcelona.
- Maire, R. & Politis, J. (1940). Hellenic fungi. An analytical list of the fungi hitherto recognized in Greece. *Actes de l'Institut botanique de l'Université d'Athènes*, 1, 27-179.
- Maire, R. & Werner, R.G. (1937). *Fungi Marocani. Catalogue raisonné des champignons connus jusqu'ici au Maroc*. Mémoires de la Société des sciences naturelles du Maroc. Mémoires de la Société des sciences naturelles du Maroc, Maroc.
- Malençon, G. (1952). Contribution à l'étude des champignons de la Kroumirie. *Bulletin de la Société Botanique de France*, 99, 33-52.
- Malençon, G. & Bertault, R. (1970). *Flore des champignons supérieurs du Maroc*. Flore des champignons supérieurs du Maroc. Institut Scientifique Chérifien et de la Faculté des Sciences de Rabat, Maroc.
- Malençon, G. & Bertault, R. (1975). *Flore des champignons supérieurs du Maroc*. Flore des champignons supérieurs du Maroc. Institut Scientifique Chérifien et de la Faculté des Sciences de Rabat, Maroc.
- Manic, S. (2016). The macromycetes of the downy oak forests from moldova. *Journal of Plant Development*, 23.
- Massee, G. (1889). A Monograph of British Geastrumycetes. In: *Annals of botany*. Academic Press, London, pp. 1-105.
- Matheny, P.B. & Swenie, R.A. (2018). The *Inocybe geophylla* group in North America: a revision of the lilac species surrounding *I. lilacina*. *Mycologia*, 110, 618-634.
- May, T., Milne, J., Shingles, S. & Jones, R. (2003). *Catalogue and Bibliography of Australian Fungi: Basidiomycota P. P. and Myxomycota P.P.* ABRIS, Canberra/CSIRO Publishing, Australia.
- May, T.W., Redhead, S.A., Bensch, K., Hawksworth, D.L., Lendemer, J., Lombard, L., et al. (2019). Chapter F of the International Code of Nomenclature for algae, fungi, and plants as approved by the 11th International Mycological Congress, San Juan, Puerto Rico, July 2018. *IMA Fungus*, 10, 21.
- Mazza, R. (1998). Introduzione alla «micologia». *Pagine di Micologi*, 10, 29-96.
- McIlvaine, C. & Macadam, R.K. (1912). *One Thousand American Fungi: Toadstools, Mushrooms, Fungi, Edible and Poisonous : how to Select and Cook the Edible : how to Distinguish and Avoid the Poisonous, with Full Botanic Descriptions*. Bobbs-Merrill.
- Migliozzi, V. & Camboni, M. (2001). La micoflora del litorale romano. 5° contributo. Alcune specie comuni della spiaggia di Ostia Lido: *Agaricus menieri*, *Hygrocybe acutoconica* var. *aurantiolutescens* stat. nov., *Oudemansiella mediterranea* e *Gyrophragmium dunalii*. *Micologia Italiana*, 30, 36-45.
- Milne Edwards, M. (1842). *Annales des sciences naturelles*. Masson, Paris.
- Moser, M. (1952). Cortinarien-Studien. *Sydowia*, VI, 17-161.
- Moser, M. (1955). Studien zur Gattung *Oudemansiella* Speg., Schleim- und Sammetrüblinge. *Zeitschr Pilzk*, 21, 4-11.
- Naseer, A., Asghar, H.S., Khurshid, R. & Rehman, A. (2019). The Genus *Otidea* (Pezizales, Pyrenomataceae) from Pakistan. *Sylwan*, 163, 145-155.
- Nezzar-Hocine, H., Bouteville, R.J., Guinberteau, J., Perrin, R. & Chevalier, G. (1998). La macroflore fongique de *Cedrus atlantica* (Endl.) Manetti ex Carrière II-Les champignons ectomycorhiziens d'une cédraie du massif du Djurdjura (Algérie). *Cryptogamie Mycol*, 19, 139-161.
- Nezzar-Hocine, H., Bouteville, R.J., Halli-Hargas, R. & Chevallier, G. (1996). La macroflore fongique de *Cedrus atlantica* (Endl.) Manetti ex. Carrière. I-Inventaire des espèces d'une cédraie du massif du Djurdjura (Algérie) et connaissances actuelles sur les champignons des cédraies. *Cryptogamie Mycol*, 17, 85-103.
- Niego, A.G., Raspé, O., Thongklang, N., Charoensup, R., Lumyong, S., Stadler, M., et al. (2021). Taxonomy, Diversity and Cultivation of the Oudemansielloid/Xeruloid Taxa *Hymenopellis*, *Mucidula*, *Oudemansiella*, and *Xerula* with Respect to Their Bioactivities: A Review. *Journal of Fungi*, 7, 51.
- Nounsi, A., Outcoumit, A., Selmaoui, K., Ouazzani Touham, A., Benkirane, R. & Douira, A. (2014). Inventaire des champignons ectomycorhiziens du Maroc. *Journal of Applied Biosciences*, 79, 6826-6854.
- O'Reilly, M. (2020). New records of sessile earthstars (*Geastrum fimbriatum*) and collared earthstars (*Geastrum triplex*) from the Glasgow area, Scotland. *Journal of the Glasgow Natural History Society*, 27, 82-85.
- Orton, P.D. (1960). New check list of British agarics and boleti. *T Brit Mycol Soc*, 43, 159-384.
- Outcoumit, A., El kholfy, S., Ouazzani Touham & Douira, A. (2014). Bibliographic Inventory of Tangier Fungi: Catalogue of the Basidiomycetes Fungal Flora. *International Journal of Plant, Animal and Environmental Sciences*, 4, 205-256.
- Pál-Fám, F. & Benedek, L. (2022a). A galambgomba (*Russula*) nemzetség a Székelyföldön I. Fajlista, Compactae, Heterophyllidia és *Ingratula* alnemzetségek. *Moeszia. Erdélyi Gombász*, 11-12, 3-16.
- Pál-Fám, F. & Benedek, L. (2022b). The genus *Russula* in Székelyland, Transylvania I. Species list, Compactae, *Heterophyllidia* and *Ingratula* subgenera. *Moeszia. Erdélyi Gombász*, 11-12, 17-21.
- Parslow, M. & Spooner, B.M. (2015). The British species of *Otidea* (2), *O. alutacea* and related taxa. *Ascomycete. org*, 7, 295-302.

- Patouillard, N. (1887). *Anatomie générale et classification des champignons supérieurs : les hyméno-mycètes d'Europe*. Librairie Paul Klincksieck, Paris.
- Patouillard, N.T. (1897). Additions au catalogue des champignons de la Tunisie. *Bulletin de la Société Mycologique de France*, 13, 197-217.
- Patouillard, N.T. (1902). Champignons Algéro-Tunisiens nouveaux ou peu connus (suite). *Bulletin de la Société Mycologique de France*, 18, 46-53.
- Patouillard, N.T. (1903). Additions au catalogue des champignons de la Tunisie (suite). *Bulletin de la Société Mycologique de France*, 19, 254-261.
- Patouillard, N.T. (1905). Champignons Algéro-Tunisiens nouveaux ou peu connus (suite). *Bulletin de la Société Mycologique de France*, 21, 117-122.
- Patouillard, N.T. (1906). Champignons Algéro-Tunisiens nouveaux ou peu connus (suite). *Bulletin de la Société Mycologique de France*, 22, 195-201.
- Patouillard, N.T. (1920). Procès verbaux des séances: Séance du 6 Mai 1920. *Bulletin de la Société Mycologique de France*, XXXVI, 121-124.
- Peck, C.H. (1885). *Annual Report of the State Museum of Natural History-Plants not before reported* (Annual No. 38). Report of the Botanist (1884). Annual Report on the New York State Museum of Natural History. Albany, USA.
- Pegler, D.N. & Young, T.W.K. (1986). Classification of *Oudemansiella* (Basidiomycota: Tricholomataceae), with special reference to spore structure. *T Brit Mycol Soc*, 87, 583-602.
- Persoon, C.H. (1794). Dispositio methodica fungorum. *Neues Magazin für die Botanik*, 1, 81-128.
- Persoon, C.H. (1801). *Synopsis methodica fungorum : sistens enumerationem omnium huc vsque detectarum specierum, cum breuibus descriptionibus nec non synonymis et obseruationibus selectis*. Apud Henricum Dieterich, Gottingae.
- Petersen, R.H. & Hughes, K.W. (2010). *The Xerula/Oudemansiella complex (Agaricales)*. Nova Hedwigia. Beiheft. Stuttgart.
- Poumarat, S. (2017). Clé des gastéromycètes épigés d'Europe. Fédération des Associations Mycologiques Méditerranéennes, Nice.
- Quélet, L. (1886). *Enchiridion fungorum in Europa media et praesertim in Gallia vigentium*. Octave Doin, Lutetiae.
- Raudabaugh, D.B., Matheny, P.B., Hughes, K.W., Iturriaga, T., Sargent, M. & Miller, A.N. (2020). Where are they hiding? Testing the body snatchers hypothesis in pyrophilous fungi. *Fungal Ecol*, 43, Article 100870.
- Reumaux, P., Bidaud, A., Moëgne-Loccoz, P. & Moreau, P.-A. (1996). *Russules rares ou méconnues*. Fédération Mycologique Dauphiné-Savoie, Marlioz (France).
- Richter, C., Yurkov, A.M., Boekhout, T. & Stadler, M. (2019). Diversity of Tilletiopsis-Like Fungi in Exobasidiomycetes (Ustilaginomycotina) and Description of Six Novel Species. *Front Microbiol*, 10, 1-14.
- Ricken, A. (1915). *Die Blätterpilze (Agaricaceae) Deutschlands*. Theodor Oswald Weigel, Leipzig, Allemagne.
- Riva, A. (2009). Revisione e Commento dei Tricolomi Di G. Malençon e R. Bertault: Flore des champignons supérieurs du Maroc, tome II. In: *Compléments à la flore des champignons supérieurs du Maroc de G. Malençon et R. Bertault* (eds. Maire, J.-C., Moreau, P.-A. & Robich, G.). Confédération Européenne de Mycologie Méditerranéenne, pp. 407-418.
- Romagnesi, H. (1965). Étude sur le genre *Hebeloma*. *Bull. Soc. Mycol. Fr.*, 81, 321-344.
- Romagnesi, H. (1967). *Les Russules d'Europe et d'Afrique du Nord : essai sur la valeur taxinomique et spécifique des caractères morphologiques et microchimiques des spores et des revêtements*. Bordas.
- Roody, W.C. (2003). *Mushrooms of West Virginia and the Central Appalachians*. University Press of Kentucky, Kentucky-USA.
- Roux, P. (2006). *Mille et un champignons*. Éd. Roux, Sainte-Sigolène (Haute-Loire).
- Saccardo, P.A. (1887a). *Sylloge Fungorum "Omnium Hucusque Cognitorum."* Iterum impressum, Berlin.
- Saccardo, P.A. (1887b). *Sylloge fungorum omnium hucusque cognitorum: Sylloge Hymenomycetum. Agaricineae*. Typis Seminarii.
- Saccardo, P.A. (1891). *Sylloge fungorum omnium hucusque cognitorum*. sumptibus auctoris, Patavii.
- Sarnari, M. (1992). *Russula nuove o interessanti dell'Italia centrale e mediterranea- XVII contributo. Bollettino dell'Associazione Micologica Ecologica Romana*, 25, 9-18.
- Sarnari, M. (1993). *Russule nuove o interessanti dell'Italia Centrale e mediterranea. 18° contributo. Le sottosezioni Griseinae e Illicinae nell'Italia centrale. Micol. Veg. Medit.*, 8, 15-56.
- Schäffer, J. (1938). Beiträge zur *Russula* -Forschung III. *Annales Mycolagici*, 1, 27-43.
- Schild, E. (1975). Die Gruppe Flaccidae der Gattung *Ramaria* : ein Beitrag zur Klärung von *Clavariella corrugata* (Karst.) Karst., *Clavariella eumorpha* (Karst.) Karst. und *Clavaria invalii* Cott. & Wakef. *Zeitschrift für Pilzkunde*, 35, 129-135.
- Schwöbel, H. (1975). Die Täublinge. Beiträge zu ihrer Kenntnis und Verbreitung (IV). *Zeitschrift für Pilzkunde*, 41, 123-142.
- Segedin, B.P. & Pennycook, S.R. (2001). A nomenclatural checklist of agarics, boletes, and related secotioid and gasteromycetous fungi recorded from New Zealand. *New Zeal J Bot*, 39, 285-348.
- Selosse, M.A. & Durieu, G. (2013). Une classification mycologique phylogénétique francophone (en 2003). *Acta Bot Gallica*, 151, 73-102.
- Senn-Irlet, B., Aeberhard, H., Bieri, G., Bovay, G., Brodtbeck, T., Keller, J., et al. (2009). Champignons du Vallon de Nant (Bex, Alpes vaudoises). *Mémoires de la Société Vaudoise des Sciences Naturelles*, 23, 29-50.
- Shiryayev, A. (2009a). Clavarioid fungi of the tundra and forest-tundra zones of Kola Peninsula (Murmansk Region). *Novosti sistematiki nizshikh rastenii*, 43, 134-149.
- Shiryayev, A. (2009b). Diversity and distribution of clavarioid fungi in Estonia. *Folia Cryptogamica Estonica*, 45, 65-80.
- Singer, R. & Kuthan, J. (1976). Einige interessante europäische *Hygrophoraceae*. *Zeitschrift für Pilzkunde*, 42, 5-14.
- Singer, Rolf. (1938). Contribution à l'étude des Russules (1)-Quelques Russules américaines et asiatiques. *Bulletin trimestriel de la Société mycologique de France*, 54, 132-177.
- Singer, Rolf. (1951). *The Agaricales (Mushrooms) in modern taxonomy*. Lilloa, Tucuman, Argentina.

- Smith, J.E. & Berkeley, M.J. (1836). *the English Flora*. Longman.
- Solak, M., Işiloğlu, M., Kalmis, E. & Alli, H. (2015). *Macrofungi of Turkey Checklist Volume-II*. İzmir: Üniversiteler Ofset.
- Souna, M., Tefiani, C., Chaouche, T., Azzi, R., Salim, H., Abdelmalek, C., *et al.* (2023). The first checklist of macro-fungi in Tlemcen Wilaya (North-West of Algeria) reveals the discovery of 5 new records for Algeria. *Genetics & Biodiversity Journal*, 7, 104-127.
- Spegazzini, C.L. (1881). Fungi argentini additis nonnullis brasiliensibus montevidensibusquei. Pugillus quartus. *Anales de la Sociedad Científica*, 12, 13-30.
- Spegazzini, C.L. & Sobré, P. (1880). La Oudemansia platensis. *Anales de la Sociedad Científica*, 10, 279-280.
- States, J.S. (1990). *Mushrooms and Truffles of the Southwest*. University of Arizona Press.
- Tkalcec, Z. & Mesic, A. (2003). Preliminary checklist of Agaricales from Croatia. V. Families Crepidotaceae, Russulaceae and Strophariaceae. *Mycotaxon -Ithaca Ny-*, 88, 279-314.
- Tortelli, M. & Kibby, G. (2020). *Cortinarius* subgenus. *Phlegmacium* in Britain. *Field Mycology*, 21, 43-70.
- Turland, N., Wiersema, J., Barrie, F., Greuter, W., Hawksworth, D., Herendeen, P., *et al.* (Eds.). (2018). *International Code of Nomenclature*.