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Research Article

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Study of some new Lepioteae for the Morocco's fungal flora

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ABSTRACT

The surveys in the forest of Mamora and in the coastal mobile dunes of Mehdia (North western Morocco) between 2010 and 2012, enabled us to identify six new species of Lepioteae for the Morocco's fungal flora, including four species of the Lepiota genus (Lepiota farinolens, L. rhodorrhiza, L. alba and L. badhami), a species of Chlorophyllum genus (Chlorophyllum olivieri) and a species of the Leucoagaricus genus (Leucoagaricus holosericeus).

Keywords: *Basidiomycetes, Lepiota, Chlotophyllum, Leucoagaricus, etc.*

INTRODUCTION

The Lepioteae (Agaricaceae, Agaricales, and Basidiomycetes) can be characterized by the following characters: separable pileus, free lamellae, annulus which is usually present in all genera and white basidiospores[2,4,14,21].

Lepiota is a large genus comprising saprophytic species growing under trees on the forest floor or in grasslands and occurs as solitary or gregarious fruiting bodies and some of which are highly toxic, even fatal[4,14,21,23]. This genera, highly diverse in tropical and temperate regions, is characterized by white spores such as *Chamaemyces*, *Chlorophyllum*, *Coniolepiota*, *Cystolepiota*, *Eriocybe*, *Leucoagaricus* and *Leucocoprinus*, which form a monophyletic group within of Agaricaceae[5,8,11,21,23] are called lepiotaceous fungi and they show varied forms and morphological characters[24].

The *Lepiota* genus embraces varied species with cellular or filamentous pileus covering and has variable spores according to their size and shape, broadly ellipsoid or ellipsoid rammed to fusiform[4,21]. The combinations of the spores and the pileus covering structure were used in the past to distinguish the groups in terms of genera[1] and subgenera or basing on the section[15,17,18].

The *Chlorophyllum* genus belongs to the Agaricaceae (*Agaricales*, Basidiomycetes) is characterized by a hymenodermal pileus covering, a smooth stipe, and basidiospores without a germ pore or with a germ pore but just caused by a depression in the episporium[26]. The spore-print can be whitish, brownish-green or brown[17,19,20,21,22,].

The *Leucoagaricus* genus Locq. ex Singer (family *Agaricaceae*) is characterized by small to medium sized basidiocarps with lepiotoid to pluteoid habitat; radially fibrillose to floccose, scaly and rarely granulose pileus; having very short striate margin which may be collariate lamellae; central stipe with membranous annulus, metachromatic basidiospores, absence of clamp connections, presence of cheilocystidia and absence of pleurocystidia[1,15,24].

The mycoflora of the Mediterranean area in Europe and the north coastal region of California, North America, are rich in species belonging to *Leucoagaricus* Locq. ex Singer[1,3,24].

This study involves some new species of *Lepiota, Chlorophyllum* and *Leucoagaricus* to be included in the Morocco's fungal flora.

MATERIALS AND METHODS

The surveys carried out in the cork oak forest of Mamora and in coastal mobile dunes of Mehdia (North western Morocco) from winter to spring in 2010 and 2012, enabled us to encounter the *Lepiota, Chlorophylum* and *Leucoagaricus* genera. The specimens of these species were collected and brought to the laboratory. The macroscopic descriptions of carpophores focused on morphological characters (shape, color, size, appearance...) and other features related to the pileus and stipe (smell, taste ...). This description is supplemented by a microscopic description of sporae and cuts at the level of the hymenium, cuticla, flesh and stipe. The dimensions of the basidiospores, cystidia , basidia and sometimes sterigmata are measured by a micrometric eyepiece large field 10 × (18 mm) to 10 mm divided scale graduations 100 (0.1 mm). The microscopic observations have been realized using an optical microscope (magnification × 400). The mounting liquid was the rainy water.

The identification of species was based on work of Romagnesi[13], Slézec[16], Malencon and Bertault[10], Roger[12], Courtecuisse and Duhem[4], Vellinga *et al*[23], Roux[14], Vellinga and Kok[20] and Vellinga[17,18,19,24,25,26].

RESULTS

Four species of the genus *Lepiota* were studied, *Lepiota farinolens* and *L. rhodorrhiza* were harvested under *Quercus suber* in the forest of Mamora, *Lepiota alba* and *L. badhami* in coastal mobile dunes of Mehdia under *Juniperus phoenicea*, while *Chlorophyllum olivieri* and *Leucoagaricus holosericeus* were harvested respectively under *Acacia* (forest of Mamora) and *Juniperus phoenicea* (coastal mobile dunes of Mehdia).

Chlorophyllum olivieri

Humicolous species was harvested on 11/22/2010 under *Acacia* in forest of Mamora.

The pileus is (6-8.5 cm) circular, planoconvex to flat, hilly, squamulose and light gray. The flesh is thick and white. The margin is appendiceal and right. The stipe (7 x 0.6 cm) is central, fistulous, cylindrical, bulbous, fibrous and whitish. The annulus is superior and complex. The lamellae are always free, tight, uneven, potbellied and whitish. The lamellar edge is simple and regular.

The basidia (40 x 13.3 µm) are clavate, hyaline wall more or less thick and tetrasporic. The sterigmata measured 5 µm. The cheilocystidia are clavate. The spore-print is whitish. The basidiospores (11-14.9 x 7,3-8,3µm) are amygdaliformes, elliptical ($1.3 < Q < 1.6$) and smooth thick wall.

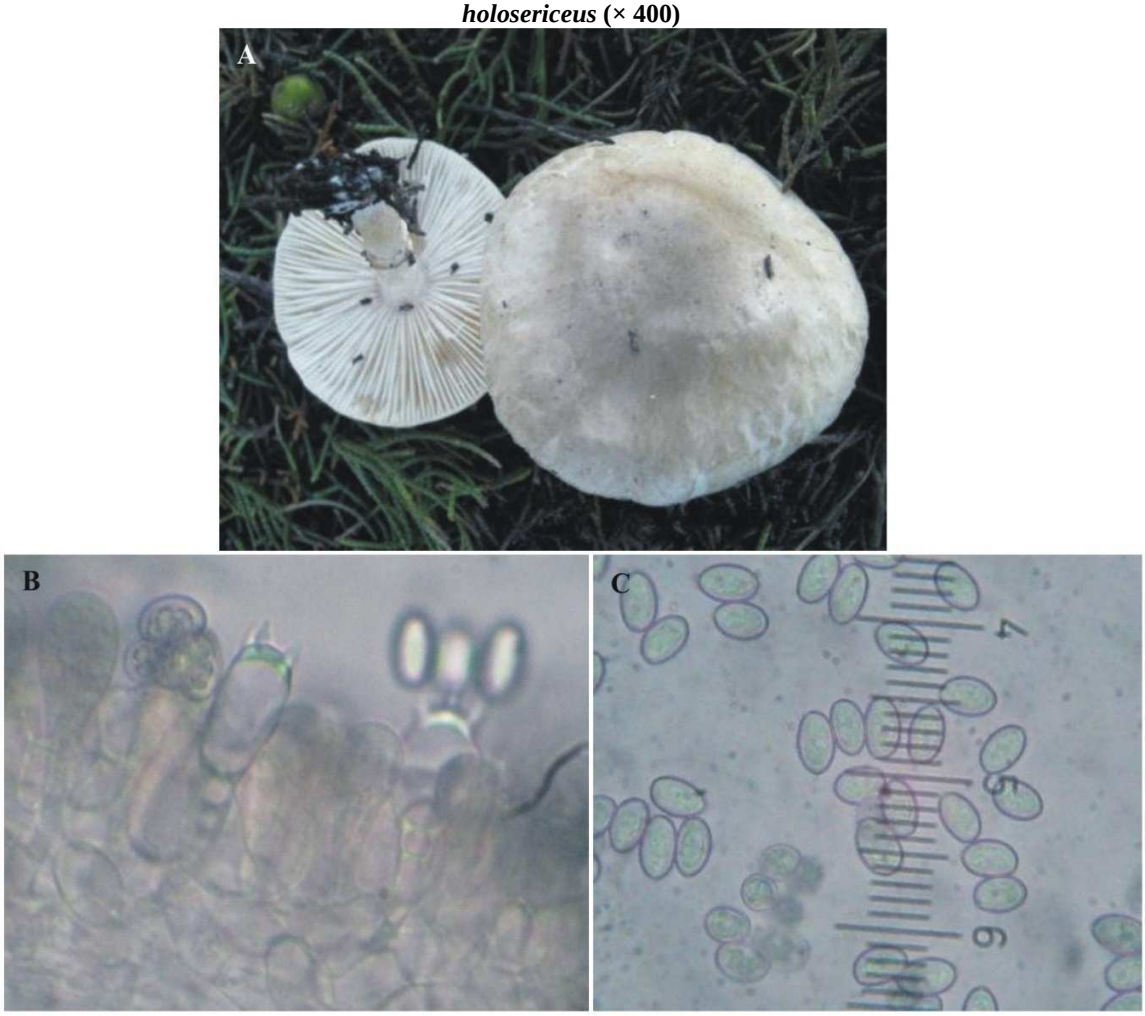
Fig.1 : Pileus (A), stipe and lamellae insertion (B), basidia (C) cheilocystidia (D), basidiospores (E) of *Chlorophyllum olivieri* (× 400)

Leucoagaricus holosericeus

Species was harvested on 03/15/2009 in coastal mobile dunes of Mehdia on the sand and under *Juniperus phoenicea*.

The pileus (5-7 cm) is convex to planoconvex, smooth and light beige to greyish reflet. The flesh is thick and white. The margin is smooth and curved. The stipe (5 x 0.8 cm) is central, full, cylindrical and white. The annulus is superior. The lamellae are free, tight, uneven, and whitish. The lamellar edge is simple and toothed. The basidia (40-50 × 10-16.6 µm) are clavate, hyaline wall more or less thick and tetrasporic. The sterigmata measured 6.66 µm. The spore-print is whitish. The basidiospores (11.65 to 13.3 x 6.66 to 8.3 microns) are elliptical amygdaliformes (1.3 < Q < 1.6) and smooth thick wall.

Fig. 2: Pileus, stipe, annulus and lamellae insertion (A), Basidia(B) and basidiospores (C) of *Leucoagaricus holosericeus* (× 400)



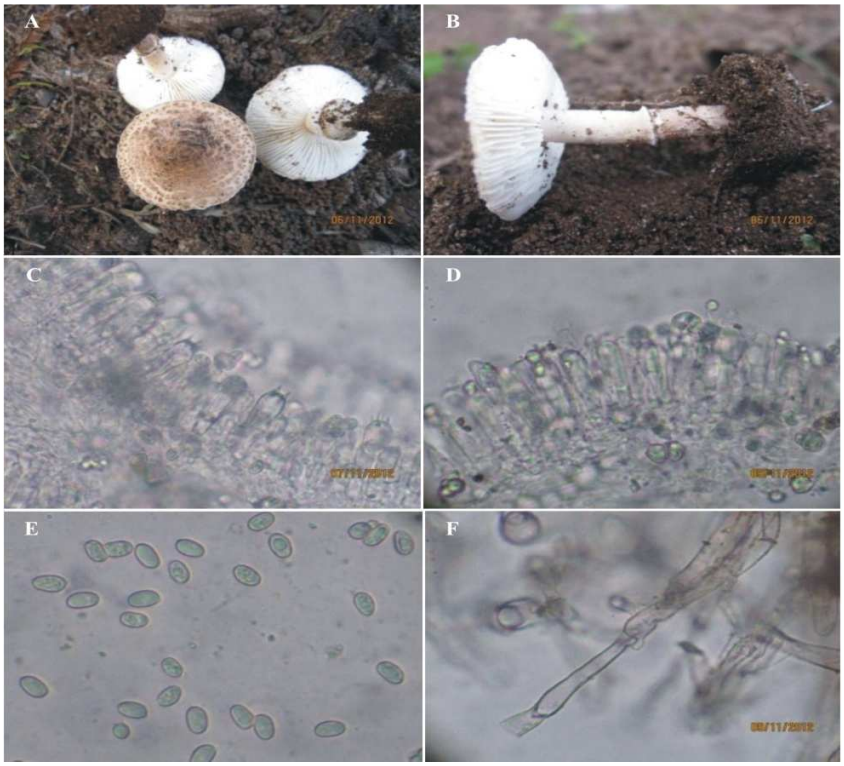
Lepiota farinolens

Humicolous species was harvested on 01/11/2012 under *Quercus suber* in Mamora's forest.

The pileus (1-2 cm) is circular, convex to planoconvex, hilly, squamulos and white to pinkish reflet. The flesh is more or less thick in the center, to the thinned margin and whitish. The margin is appendiceal. The stipe (1.5-2.5 × 0.3-0.4 cm) is cylindrical, central, full and whitish to pinkish reflet. The annulus is simple and inferior. The lamellae are free, little tight, uneven and whitish. The lamellar edge is simple and regular.

The basidia (23.3-26.6 × 6.66 to 8.32 µm) are hyaline, clavate and tetrasporic. The sterigmata measured 3.33 µm. The cheilocystidia are clavate. The basidiospores (6.6-7.3 × 3.33-4 µm) are elliptical (1.3 < Q < 1.6), hyaline and more or less thick wall.

Fig. 3: Pileus and lamellae insertion (A), stipe and annulus (B), Basidia(C), Cheilocystidia (D), basidiospores (E) and buckles (F) of *Lepiota farinolens* (× 400)



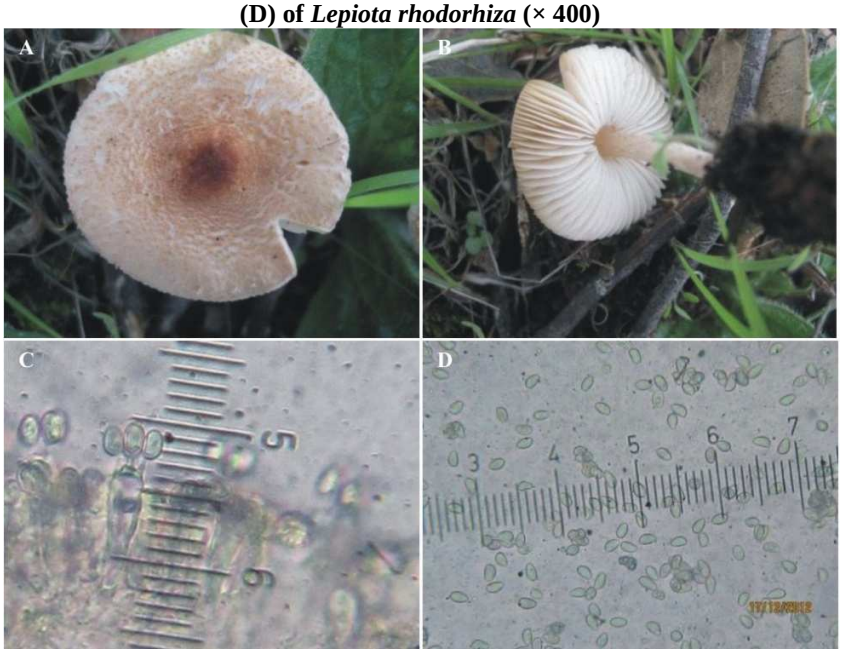
Lepiota rhodorhiza

Humicolous species was harvested on17/12/2012 under *Quercus suber* in Mamora's forest.

The pileus (1-2.5 cm) is circular, plano-convex, squamous, and hummocky dark brown to light brown in the center to the margin. The flesh is white and thin. The margin is smooth and straight. The stipe (3 x 0.3 cm) is central, hollow, cylindrical, mealy and bench-beige. The annulus is superior and fleeting. The lamellae are free, tight, uneven, large and whitish. The lamellar edge is simple and regular.

The basidia (20 × 6.66 µm) are clavate, hyaline wall more or less thick and tetrasporic. The sterigmata measures 1 µm. The spore-print is whitish. The basidiospores (6.66-7.3 x 3,33-4 µm) are amygdaliformes, elliptical ($1.3 < Q < 1.6$) and smooth thick wall.

Fig. 4: Pileus (A), stipe and lamellae insertion (B), Basidia(C) and basidiospores (D) of *Lepiota rhodorhiza* (× 400)



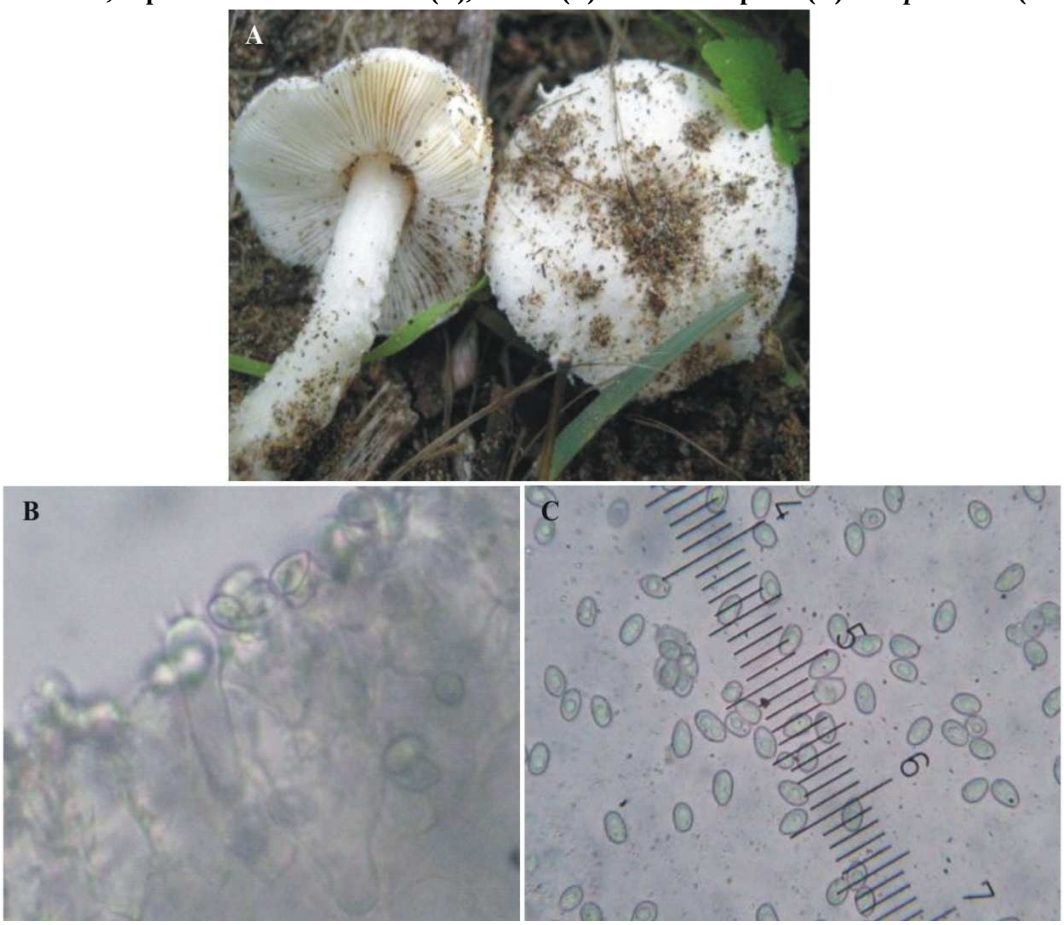
Lepiota alba

Species was harvested on 21/01/2010 in coastal mobiles dunes in Mehdia on the sand and under *Juniperus phoenicea*.

The pileus (4-5 cm diameter) is circular, planoconvex, smooth, hummocky and white. The flesh is more or less thick and whitish. The margin is simple and straight. The stipe (5 × 0.55 cm) is cylindrical, central, full, bulbous and whitish. The annulus is present in the center. The lamellae are free, little tight, bulging, uneven and whitish. The lamellar edge is simple and regular.

The basidia (19.9 × 8.65 µm) are hyaline, clavate and tetrasporic. The sterigmata measured 3.3 µm. The basidiospores (7.3-8.3 × 3.9-4.9 µm) are elliptical (1.3 < Q < 1.6) and more or less thick wall.

Fig. 5: Pileus, stipe and lamellae insertion (A), Basidia(B) and basidiospores (C) of *Lepiota alba* (× 400)



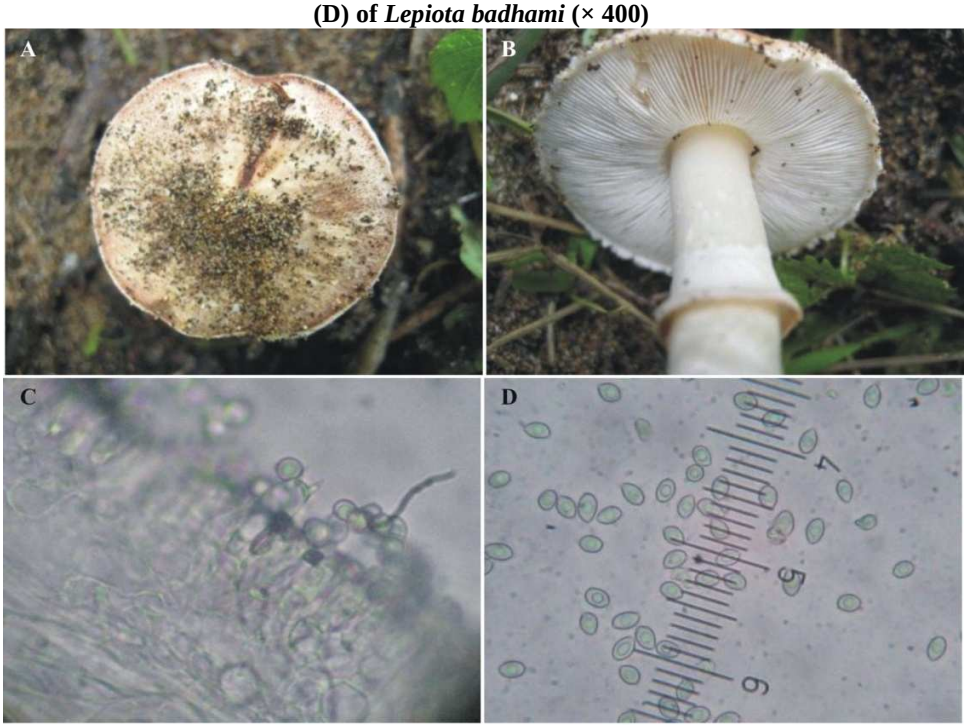
Lepiota badhami

Species was harvested on 21/01/2010 in coastal mobiles dunes in Mehdia on the sand and under *Juniperus phoenicea*.

The pileus (3.5-4 cm) is convex to planoconvex, smooth, hummocky and pinkish color on a white background. The flesh is white and more or less thick. The margin is smooth and curved. The stipe (5 x 0.5 cm) is central, in full sinus, curved, cylindrical, and color fibrillose bench. The annulus is superior. The lamellae are tight, uneven, free and cream white. The lamellar edge is simple.

The basidia (33.3 × 8.3 µm) are clavate, hyaline wall more or less thick and tetrasporic. The sterigmata measures 1.6 µm. The spore-print is whitish. The basidiospores (7 x 4,3µm) amygdaliformes are elliptical (1.3 < Q < 1.6) and smooth thick wall.

Fig. 6: Pileus (A), stipe, annulus and lamellae insertion (B), Basidia (C) and basidiospores (D) of *Lepiota badhami* (× 400)



DISCUSSION

In Morocco, Malencon and Bertautl[10] studied three genus of Lepiotoideae (*Lepiota, Cystoderma* and *Psalliota*), by against, these two mycologists have never reported *Chlorophyllum* and *Leucoagaricus*.

Among the thirty nine species of the genus *Lepiota* studied by Malencon and Bertautl[10], twenty species have been described, while the others were only mentioned in different regions of Morocco (Tangier, the Rif, Central Plateau, Mamora' forest, coastal Meseta, Middle Atlas, High Atlas) under different vegetations (*Quercus suber*, *Q. rotundifolia, Q. faginea, Q. pyrenaica, Acacia, Eucalyptus, Pinus, Cedrus* and *Quercetum ilicis*).

Fourteen species and varieties of the *Lepiota* genus are described: eleven were identified in Mamora, two are from the Rif and Benslimane (*Lepiota acutesquamosa, L. bresadolae, L. brunneoincarnata, L. clypeolaria, L. cristata L. excoriata, L. fuscosquamosa, L. helveola, L. mastoidea, L. naucina, L. procera L. procera* var.?., *L. rhacodes, L. rhacodes* var.?)[7]

Four species of Lepitoides were encountered in the Rif, *Lepiota castanea, L. ignivolvata*, *Leucoagaricus subcretaceus* and *Macrolepiota procera*[9].

Ten species of *Lepiota* genus, including four species (*Macrolepiota ricknii, M. fuligneosquarrosa, Lepiota pseudofelina, L. josserandii*) which were newly harvested for Morocco's fungal flora, two new species in the Mamora' forest (*Lepiota naucina* and *Macrolepiota mastoidea*) and four already cited by Malencon and Bertault[10] described for the first time, as well as *Leucocoprinus denudatus* which is new to the Morocco's fungal flora[6].

CONCLUSION

In this study six species are newly harvested and added to the Morocco's fungal flora, including four species (*Lepiota farinolens, L. rhodorrhiza, L. alba* and *L. badhami*) belonging to the *Lepiota* genus, a species of the *Chlorophyllum* genus (*Chlorophyllum olivieri*) and a species of *Leucoagaricus* genus (*Leucoagaricus holosericeus*).

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