PRELIMINARY INVESTIGATION ON MACROFUNGAL FLORA ALONG THE PROVINCIAL ROAD NO. 723 BELONGING TO BIDOUP – NUI BA NATIONAL PARK (LAM DONG PROVINCE)

PHAM NU KIM HOANG, PHAN HUU HUNG, DO THI THIEN LY, LE THI CHAU
Tay Nguyen Institute for Scientific Research, Vietnam Academy of Science and Technology

TRUONG BINH NGUYEN
Dalat University

Mushroom is a macrofungus (Chang and Miles, 1992) [3], which has a distinctive fruiting body, large enough to be seen with naked eye and to be picked by hand. The number of mushroom species on our planet has been evaluated at between 53,000 and 110,000, and only 18-38% of these numbers have been documented [9]. Understanding about the diversity of mushroom species in the specific areas is valuable not only for the fundamental researches of natural resources but also to the development of the economy and society at these areas.

With a length of 130 kilometers the provincial road No. 723 is a new road connecting Dalat and Nha Trang cities. This road goes through the core area of the Bidoup-Nui Ba National Park - one of the four centers of biodiversity in Vietnam having medium and high mountains and defined to be in the massif of Southern Truong Son range with the average elevation from 1,500 to 1,800 meters above sea level. Its geographical coordinates are 12°00'N to 12°52'N north latitude and 108°17'E to 108°42'E east longitude. The Park holds typical forest ecosystems of subtropical alpine climate with many forest types such as evergreen, open coniferous, broadleaf-coniferous mixed forest, high-mountain dwarf forest, mossy, bamboo, broadleaf-bamboo mixed forest, and grassland [1]. With these characteristics, the Bidoup-Nui Ba National Park is arranged to be the first priority for conversation of biology of Vietnam. However, there is currently no report on the diversity of macrofungi flora for this park. This report presents the preliminary investigation about species composition of macrofungi along the provincial road No. 723.

I. RESEARCH METHODS

Mushroom sampling was done along the provincial road No. 723 between April and November of 2011 and 2012 with the aim of forming an initial checklist of mushrooms for the Bidoup-Nui Ba National Park. Specimens were collected along both sides of the road with about one kilometer in width. The samples were numbered, photographed, and macroscopic characters were studied followed by the methods of Trinh Tam Kiet (1981) [13] and Singer (1986) [11]. Specimens were collected for both describing microscopic appearances and preservation at the department of Micro-biotechnology (Tay Nguyen Institute for Scientific Research). Pictures shown below were taken during our collection trips. The identification of specimens was based on morphological and anatomical characteristics was compared with the original documentation of Teng (1964) [12], Corner (1966) [5], Petersen (1977) [10], Trinh Tam Kiet (1981) [13], Breitenbach & Kränzlin (1986) [2].

II. RESULTS AND DISCUSSION

1. Macrofungi flora:

According to Lincoff (2010) [8], the macrofungi, collected in the wild, except for the morels and a few others (ascomycetes fungi), almost all belong to the basidiomycetes group. Here, 71

collections representing 71 distinctive species were gathered along the provincial road No. 723 in our investigation.26 out of 71 collected specimens were identified up to species level, the remaining ones were classified to different genera. All species represented 36 genera, 21 families, 10 orders, and two phyla of mushrooms (the checklist was shown in the index). The majority also came from the Phylum Basidiomycota with 70 samples and only one belonged to the Phylum Ascomycota (Xylariales, Xylariaceae Tul. & C. Tul.*Xylaria* Hill ex Schrank). Among the Phylum Basidiomycota, most of the number of found belonged to the families Polyporaceae and Boletaceae with 16 and 11 samples, respectively. The remaining families had one to four samples, excepting the families Ganodermataceae with eight and Russulaceae with six samples.

Besides taxonomic diversity, the collection also represented multiple fruiting body morphologies. They varied from the major groups such as gilled (fig. 1 and 2), pore surfaced (fig. 3 and 4), tooth (fig. 5 and 6), coral-like fungi (fig. 7), to the rare ones such as crust and parchment fruiting bodies (fig. 8), puffballs (fig. 9), jelly (fig. 10), stinkhorn (fig. 11), and finger-like mushrooms (fig. 12). This preliminary result is a significant step towards forming a checklist of the macrofungi for the whole National Park area because there are not many systematical studies on this flora till now.

Depending on how they get nutrients, mushrooms are saprophytic, parasitic or symbiotic [7]. Among samples identified to the species level, 16 samples were recorded to be saprophytic mushrooms such as *Omphalotus japonicus, Fomitopsis ostreiformis, Clavicorona pyxidata* (fig. 2, 4, and 7). Eight out of 26 samples were mycorrhizal fungi, such as *Amanita virgineoides, Boletus speciosus* (fig. 1 and 3). However, it is not always easy to classify a mushroom on the basis of mode of nutrition. We found out two samples named *Ganoderma adspersum* and *Ganoderma applanatum* that are both saprobic and parasitic during their life cycle (table 1). In the early stages of colonization, *Ganoderma adspersum* is seen to be a tree parasite, but since its host dies, the mushroom becomes saprobic and decomposes dead wood. In the meantime, *Ganoderma applanatum* is a wood-decay fungus by using mainly dead heartwood, but also a parasite on live sapwood, seen particularly on old trees. This mushroom is a common cause of death and decay of poplars and beeches [6].

Table 1

Mode of nutrition

Category	No. of species	Percentage
Saprophyte	16	61.54
Mycorrhizae	8	30.77
Parasite and saprophyte	2	7.69

2. Uses of Mushrooms found along provincial road

The determination of edibility or or toxicity of a mushroom is sometimes confused and not always simple. There are contradictory reports in guides about edibility when some qualified as edible species that were realizing inedible. For example, while *Gyromitra esculenta* – a false morel is seen as a culinary delicacy by people in eastern Finland, it is stated emphatically as a poisonous in the United States [7]. Similarly, there is a difference in the definition of edible mushrooms and mushrooms using as food; or inedible and poisonous mushrooms. Thus, the determination of the use-value in this study was based on the reports of Hall et al. (2003) [7]. The result of the investigation showed that the mushrooms resources in the Bidoup-Nui Ba National Park had high potential values (table 2). Just along the provincial road No. 723, 12 out

of 26 identified samples were edible, including six species that were widely used as food and one species that was eaten with caution (*Pleurocybella porrigens*). The number of inedible mushrooms found in the study was 11, exclusive of three potentially deadly ones (fig. 2, 4, and 11).

Fig. 1: ***Amanita virgineoides***

Fig.2: ***Omphalotus japonicus***

Fig. 3: ***Boletus speciosus***

Fig. 4: ***Fomitopsis ostreiformis***

Fig. 5: ***Creolophus sp.***

Fig. 6: ***Hydnellum sp.***

Fig. 7: ***Clavicorona pyxidata***

Fig.8: ***Hymenochaete rubiginosa***

Fig. 9: ***Scleroderma sp.***

Fig. 10: ***Auricularia delicate***

Fig. 11: ***Phallogaster saccatus***

Fig. 12: ***Xylaria sp.***

Remarkably, the result was also valuable for detecting medicinal mushrooms. Nine out of 26 samples belonging to both edible and inedible mushrooms had medicinal properties. The medicinal uses of mushrooms have been defined through their use in traditional medicine by rural people for years (*Auricularia delicate)* or through official report on their active agents (*Trametes hirsuta* or *Omphalotus japonicus*).

Table 2

Numbers of mushroom species and their uses

Category	No. of species
1 Edible only	3
2 Edible and medicinal	3
3 Food only	5
4 Food and medicinal	1
5 Inedible	7
6 Inedible but medicinal	4
7 Poisonous	2
8 Poisonous but medicinal	1
T**OTAL IDENTIFIED SPECIES**	**26**

Although just 26 samples holding one-third of the found numbers were identified to species level, there were nine medicinal species. This would suggest that the number of valuable species will be much higher than that if all samples in the investigation are analyzed. The result of this study will be a source of valuable information in the evaluation of the mushroom reserve in the Bidoup-Nui Ba National Park.

III. CONCLUSION

The species composition of macrofungi along the road No. 723 was plentiful. A checklist of 71 mushroom species belonging to 36 genera and 21 families were established. Almost all the samples belonged to the Phylum Basidiomycota (70) and 26 samples were identified to species level. Large diversity in morphology of fruiting bodies was observed.

As well as morphological richness, the ecological roles of the samples represented a diversity, including saprophyte, parasites, and mycorrhizae. Seven out of 12 edible mushrooms were food as well as nine species had medicinal properties.

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ĐIỀU TRA BAN ĐẦU VỀ KHU HỆ NẤM LỚN DỌC TUYẾN ĐƯỜNG TỈNH 723 THUỘC VƯỜN QUỐC GIA BIDOUP-NÚI BÀ (LÂM ĐỒNG)

PHẠM NỮ KIM HOÀNG, PHAN HỮU HÙNG,
ĐỖ THỊ THIÊN LÝ, LÊ THỊ CHÂU, TRƯƠNG BÌNH NGUYÊN

TÓM TẮT

Bài báo ghi nhận kết quả khảo sát thành phần loài khu hệ nấm lớn dọc tuyến đường mới 723 chạy ngang qua vùng lõi vườn Quốc gia Bidoup-Núi Bà (tỉnh Lâm Đồng) trong hai năm 2011 và 2012. 71 mẫu nấm lớn, tương ứng cho 71 loài được tìm thấy trong đó ngành nấm đảm chiếm đa số (70 mẫu) và chỉ một mẫu thuộc ngành nấm túi. Các mẫu thu thập được có hình dạng quả thể đa dạng nằm trong 36 chi, 21 họ và 10 bộ của giới Nấm, bao gồm các loài nấm có bào tầng dạng phiến, dạng ống, dạng răng, nấm hình ngón tay, nấm tuyết, nấm cục, nấm san hô, … Trong số 26 mẫu đã được định danh đến loài có 16 mẫu hoại sinh, tám mẫu cộng sinh, 12 mẫu nấm ăn được, và chín mẫu nấm dược liệu hoặc có hoạt tính sinh học.

Index 1: **Checklist of macrofungi along the Provincial road No. 723**

BASIDIOMYCOTA
AGARICOMYCETES
AGARICALES
Amanitaceae

1. *Amanita* sp.
2. *Amanita virgineoides* Bas 1969 (food)

Marasmiaceae

3. *Omphalotus japonicus* (Kawam.) Kirchm. & O.K. Mill. 2002 (poisonous but medicinal)
4. *Omphalotus* sp.
5. *Pleurocybella porrigens*(Pers.) Singer 1947 (food)

Physalacriaceae

6. *Oudemansiella* sp.

Pleurotaceae

7. *Pleurotus* sp.1
8. *Pleurotus* sp.2

AURICULARIALES

Auriculariaceae

9. *Auricularia delicate* (Mont.) Henn. 1893 (food and medicinal)

BOLETALES

Boletaceae

10. *Boletus* sp.1
11. *Boletus* sp.2
12. *Boletus* sp.3
13. *Boletus* sp.4.
14. *Boletus* sp.5
15. *Boletus* sp.6
16. *Boletus* sp.7
17. *Boletus* sp.8.
18. *Boletus speciosus* Frost 1874 (food)
19. *Leccinum extremiorientale* (Lar. N. Vassiljeva) Singer 2000 (food)
20. *Tylopilus* sp.

Sclerodermataceae

21. *Scleroderma* sp.1
22. *Scleroderma* sp.2

Suillaceae

23. *Suillus piperatus* (Bull.) Kuntze 1898 (edible)

GLOEOPHYLLALES

Gloeophyllaceae

24. *Neolentinus lepideus* (Fr.) Redhead& Ginns 1985 (edible and medicinal)

HYMENOCHAETALES

Hymenochaetaceae

25. *Hymenochaete rubiginosa* (Dicks.) Lév. 1846 (inedible)
26. *Inonotus* sp.
27. *Phellinus* sp.1
28. *Phellinus* sp.2

HYSTERANGIALES

Phallogastraceae

29. *Phallogaster saccatus* Morgan 1893 (poisonous)

POLYPORALES

Fomitopsidaceae

30. *Fomitopsis ostreiformis* (Berk.) T. Hatt. 2003 (poisonous)
31. *Postia* sp.1
32. *Postia* sp.2
33. *Ischnoderma* sp.

Ganodermataceae

34. *Ganoderma adspersum* (Schulz.) Donk. 1969 (inedible)
35. *Ganoderma applanatum* (Pers. ex Wallr.) Pat. (inedible but medicinal)

36. *Ganoderma multipilea* Ding Hou 1950 (edible and medicinal)
37. *Ganoderma* sp.1
38. *Ganoderma* sp.2
39. *Ganoderma* sp.3
40. *Ganoderma* sp.4
41. *Ganoderma* sp.5

Meruliaceae

42. *Bjerkandera* sp.

Polyporaceae

43. *Cryptoporusvolvatus* (Peck) Shear 1902 (inedible but medicinal)
44. *Lenzites* sp.
45. *Microporus flabelliformis* (Fr.) Pat.1898 (edible and medicinal)
46. *Microporus* sp.1
47. *Microporus* sp.2
48. *Polyporellus* sp.
49. *Polyporus* sp.1
50. *Polyporus* sp.2
51. *Funalia trogii* (Berk.) Bondartsev & Singer 1941 (inedible)
52. *Trametes hirsuta* (Wulfen) Pilát 1939 (inedible but medicinal)
53. *Trametes pubescens* (Schumach.) Pilát 1939 (inedible but medicinal)
54. *Trametes* sp.1
55. *Trametes* sp.2
56. *Trametes trogii* Berk. 1850 (inedible)
57. *Trichaptum abietinum* (Pers. ex J.F. Gmel.) Ryvarden 1972 (inedible)
58. *Trichaptum* sp.

RUSSULALES

Auriscalpiaceae

59. *Clavicorona pyxidata* (Pers.) Doty 1947 (food)
60. *Lentinus* sp.

Hericiaceae

61. *Creolophus* sp.

Russulaceae

62. *Lactarius* sp.
63. *Russula cremeoavellanea* Singer 1936 (inedible)
64. *Russula fragilis* (Pers.) Fr. 1825 (inedible)
65. *Russula mariae* Peck 1872 (food)
66. *Russula risigallina* (Batsch) Saccardo, 1915 (edible)
67. *Russula* sp.

Stereaceae

68. *Stereum* sp.

THELEPHORALES

Bankeraceae

69. *Hydnellum* sp.1
70. *Hydnellum* sp.2

ASCOMYCOTA

SORDARIOMYCETES

XYLARIALES

Xylariaceae

71. Xylaria sp.