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Resilience of the Genus Agaricus to Climatic Variability in and around Ayubia National Park, Pakistan

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Abstract
The environment is being altered very quickly with the passage of time. No doubt human activities have a main role in the enhancement of certain environmental issues and these problems are affecting the natural biomes and the ecosystem world over. The biodiversity has to face these cascading problems and have to compete for their natural habitat. These environmental threats have pushed unique biodiversity at the edge of the extinction. The present study was focused to examine these issues for the members of genus *Agaricus.*

Introduction

Basidiomycota is a large and diverse group including mushrooms, boletus, puff balls, earth stars, stink horns, jelly fungi, bract or shelf fungi. Macrofungi have a distinctive fruiting body, commonly known as Basidiocarp, which may be either hypogenous or epigeous, and is large enough to be seen with naked eye and picked by hand (Hawksworth *et al*., 1995)

Agaricus is a unique type of macromycetes with a large basidiocarp. The basidiocarp is centrally stipate, fleshy. Pileus naked or squamose, with warts or smooth; epicutis cellular of fragments of palisade. Lamellae free, ultimately becoming deep colored. Spore prints purplish brown. Cheilocystidia usually present. Stipe annulate, membranous, context sometime change color when bruised. Surface often strongly react with aniline and nitric acid. (Ahmed, 1980)

The area selected for the study was Ayubia National Park situated in the Murree hills which consist of most Himalayan temperate forests of Pakistan. The geographical location of the park is 33*52'N-73*09'E with an area of 3312 ha. The park is surrounded by various small villages of the hilly areas, which are enriched with diversity of the floral population. Khanspur being the major target point of the research have its own value due to its grass lands on steep slopes and the wide variety of the vegetation.

Vegetation of the area under study comprises mostly the coniferous trees and the number of macromycetes growing with the mutual combination of the trees. The vegetation is being threatened by certain human activities like tourism; hostelling etc. 6 new species of *Agaricus* were reported form the area which was not previously not known to the available data for Pakistani mycoflora.

Materials and methods

The area was first studied well according to the environment, biodiversity and the prevailing threats to the existing biota. A three day field tour was arranged with the co ordination of some scientists from the CABI. UK for the better judgment of the issues. The area was explored for the determination of expected results.

Results

Already reported species

Agaricus alphitochrous (Ahmed. 1980)
Pileus surface breaking into dark vinaceous brown scales on a pale vinaceous pink background; epicutis of short, infaltted, interwoven hyaline elements which produce an epithelium of 1- layered structure. Context white, change into blood red on bruising. Cheilocystidia subglobose, pyriform to clavate, hyaline, thin walled. Spores ovoid to ellipsoid.

Agaricus bitorquis (Ahmed. 1980)
Pileus white, convex to expanded. Lamellae grayish when young, become dark brown are blakish at maturity. Cheilocystidia clavate. Context not changing color when bruised, stipe comparitvely short bulbous at the base, sometime rooting below annulus basal. Appearing like a volva, with a free margin. Upper part of the stipe covered with incomplete bands rarely with distinct ring in the upper part of the stipe.

Agaricus endoxanthus (Ahmed. 1980)
Pileus expanded, with a low obtuse umbo, cuticle breaking up into blakish adpressed scales, marging appendiculate. Lamellae free, annulus attached close to the stipe apex. Context white, cheilocystidia fusiform. Spores ovoid to ellipsoid.

Agaricus hemilassius (Ahmed. 1980)
Pileus surface breaking into drk brown scales. Epicutis thick of radially arranged, parallel hyphae. Context thick,

composed of interwoven inflated hyphae, constricted at the septa. Lamellae free, cheilocystidia produced as chains of globose to pyriform elements which easily become detached.

Agaricus semotus (Ahmed. 1980)

Pileus white, smooth and glabrous. Cheilocystidia obovate.

Agaricus trisulphuratus (Ahmed. 1980)

Pileus convex then expanded, cadmium orange when fresh, fading to pale cappucine orange on drying and even paler in the herbarium. Surface covered with loose fibrillose scales or meal which is caducous. Stipe concolorous, covered with similar mealy or furfuraceous scales. Lamellae free, fuscous. Cheilocystidia clavate. Spores phaseoliform, with a thick endosporium.

Newly reported species of *Agaricus.*

1.***Agaricus augustus*** (Cappelli, A., 1984)

Pielus with irange brown scales which are present in the form of rings, pileus margins with the remains of veil, centre of the pileus is of darker color. Pendant annulus present on the ring, fleshy stem is pink towards base. Stem ring has scales on underside. Gills are free, cream to brown colored with white edges and very crowded.

*2.**Agaricus bisporus*** (Kerrigan, Richard W.1986)

Pileus is convex to flat with smooth and dry surface. Pileus have white to dark brown color with the remain of veil at the margins. Stem ring turns upward in young specimen, faint carrot red stain on stem when bruised. Gills are free and crowded with chocolate brown color at maturity.

*3.**Agaricus sylvaticus*** (Breitenbach. 1995)

Pileus is 40-80 mm broad convex to umbonate with radiating scales on surface, centrally dark brown in color. Stipe is 100-160 x 10-15mm having fibrous scales on the surface with wide base. There is a pendent ring on the brown stipe. Gills are free and crowded with chocolate brown color at maturity while pale grey at young stages.

*4.**Agaricus compestris*** (Kerrigan, Richard W.1986)

Pileus is fleshy ,convex to flat with smooth to fibrillose surface. It may be pinkish grey in older specimen. The small stem ring is single and smooth, context white and bruised pink. Gills are free, crowded and pink in color turn chocolate brown at maturity.

*5.**Agaricus sylvicola***

Pileus more or less smooth, convex to expanded, then flat, with a yellow or off white to orange yellow in color, veil threads present at cap margin. Stipe is long slender, having large pendent double stem ring with scales underside. Upper side of the ring stained with deposited spores. Stipe have basal swelling. Gills are crowded, free and pale pink to chocolate brown in color.

Key to ***Agaricus*** species

- Phenol turn the pileus blood colored----------*Agaricus alphitochrous*
- Pileus does not have any chemical reaction
  - Fleshy stem is pink towards base----------*A. augustus*
  - Stem is not characterized as above
    - ✓ Faint carrot red stain on stem when bruising----------*A. bisporus*
    - ✓ Stem not stained on bruising
      - ❖ Enlarged skirt like veil around the stipe----------*A. silvatycus*
      - ❖ Stem ring is normally present
        - Gills are pink to chocolate brown colored----------*A. compestris*
        - Gills are normally brown with paler edges
          - ✓ Basal swelling on the base of stem----------*A. silvicola*
          - ✓ Basal swelling not found on the base
            - ❖ Pileus with a darker umbo----------*A. letertiticolor*
            - ❖ Pileus without umbo
              - Lamellae not free----------*A. woodrowii*
              - Lamellae free
                - ✓ Stipe comparatively short----------*A. bitroquis*
                - ✓ Stipe not as above mentioned
                  - ➢ Spores phaseoliform with endosporium----------*A. trisulphuratus*
                  - ➢ Spore not as above described
                    - Stipe turn yellow when bruised----------*A. endoxanthus*
                    - Stipe not as above
                      - ❖ Chilocystidia golobose to fusiform----------*A. hemilasius*
                      - ❖ Chilocystidia obovate----------*A. semotus*

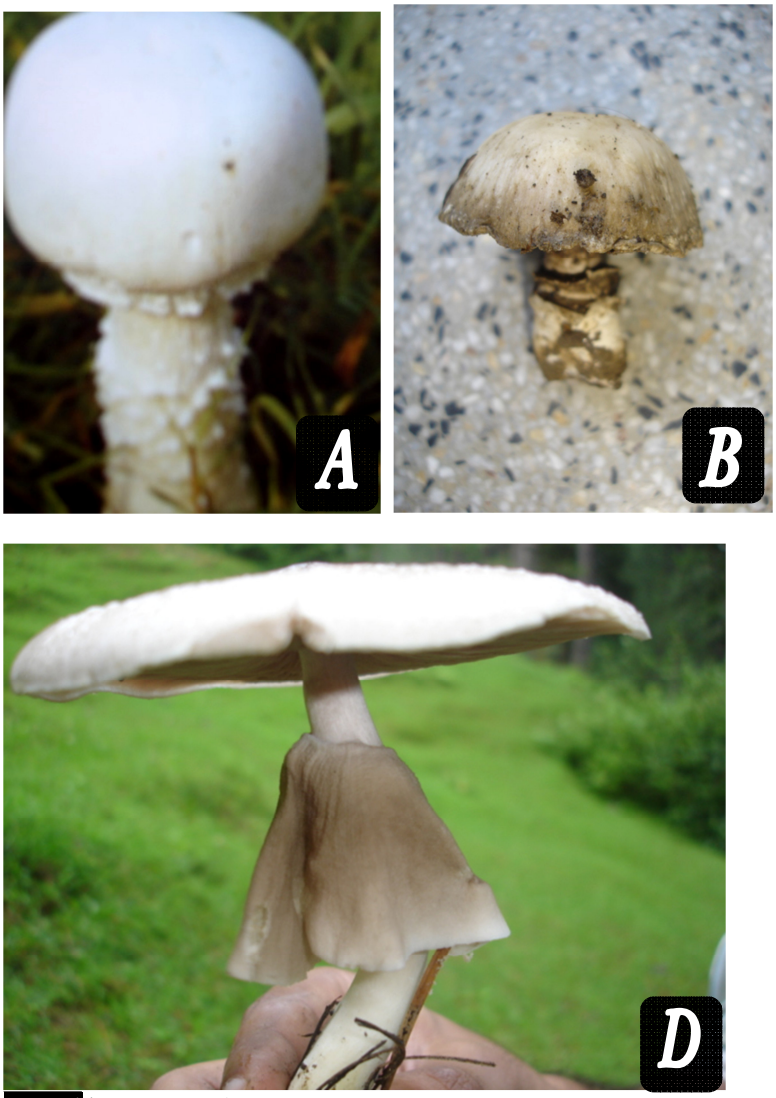

Plate 1 **A:** *Agaricus bisporus* **B:** *Agaricus augustus;* **D:** *Agaricus silvatycus;*

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