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# Record of New Species of *Phellinus* in Maharashtra India

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**Abstract:** In this study 21 species of *Phellinus* out of 90 samples from more than 20 different hosts were obtained. The specimens were identified on the basis of external and internal morphology of speciments. The results indicated that 7 species including *P. allardii*, *P. baumii*, *P. chaquensis*, *P. hippophaeicola*, *P. nilgheriensis*, *P. rhytiphloeus* and *P. setulosus* are new to India and also are new to Maharashtra as well.

**Key words:** *Phellinus*, mushroom, canker rot, heart rot, Maharashtra

## INTRODUCTION

*Phellinus* is one of the largest genus in Aphyllophorales with more than 350 species. Quelet established the genus *Phellinus* with type species of *P. igniarius* in 1886.

Taxonomic studies of the genus *Phellinus* had been extensively done throughout the world (Lloyd, 1915; Bondarzew, 1953; Overholts, 1929, 1941, 1953; Lowe, 1957; Cunningham, 1965; Fidalgo, 1968; Niemela, 1982; Ryvarden, 1972; Donk, 1974; Fiasson,1983; Gilbertson and Ryvarden, 1987; Rajchenberg 1987, 1989. *P. rubriporus* (*Phellinus torulosus*) was selected by Donk (1960) as generic nomenclature type. Then the concept of *Phellinus* has remained rather stable.

In India *Phellinus* was studied by Bagchee (1950, 1961), Singh (1966), Bakshi (1955, 1976), Thind and Dhanda (1980a), Roy (1979), Ganesh and Leelavathy (1986), Natarajan and Kolanduvelu (1985) and Vaidya and Rabba (1995).

Morphological characters of reproductive stage such as attachment of basidiocarp, types of basidiocarps, consistency, pileus surface (glabrous or hairy, dull or glossy), margin, stipitate or sessile, pore surface, number of pore per mm. Xanthocronic reaction, hyphal system, setae, basidia and basidiospore, hyphal system are used in taxonomy of *Phellinus*. Hyphal system is always dimitic in all *Phellinus* species (Ryvarden and Johanseh, 1980; Overholt, 1929; Keller, 1985).

Three hundred and sixty seven *Phellinus* has been reported in the CBS (http://www.punjabenvironment.com /bd_listhtm). Forty-seven species have already been reported from India (Rabba, 1994). Seven species are recorded for the first time from India in the present study. The aim of present investigation was to study diseases of live standing trees in park and roadside caused by genus *Phellinus* and genus *Ganoderma*.

## MATERIALS AND METHODS

Samples were collected in the sexual stages on different hosts like: *Acacia nilotica* (L) Del., *Albizzia lebbek* (L.) Benth., *Artocarpus integrifolia*, *Azadirachata indica* A. Juss., etc., from various regions of Maharashtra state like Anjrne Baneshwar, Dapoli-Dabhol road, Dabhol, Dapoli, Dongerwadi, Pune, etc. The specimens were examined for external and internal morphology.

For external morphology the material was observed for colour, texture, type of attachment to host, pore morphology, dissepiments character; margin, hymenial and pileal surface of basidiocarp.

For internal morphology, thin hand sections were taken from fruiting body passing through hymenium, which was done by chopping method. Semi-pemanent slides prepared in lactoglycerine were maintained by sealing with nail polish For amyloid and non-amyloid reaction, spores were treated with Melzer's reagent (chloral iodine solution), which turns blue. For Xanthocronic reaction 10% KOH solution was used (Beneke, 1958).

For culture small pieces (2-3 mm) of each sample from basidiocarp or decaying part of wood were plated on 2% malt agar medium as routinely. α-naphthol and guaiacol, p-cresol and pyrogallol and $H_2O_2$ tests were performed on growing mycelia of pure culture for laccases, tyrosinase and peroxidases respectively to detect the extra cellular enzymes.

The slides were observed under Bausch and Lomb compound microscope having a combination of 10x eyepiece and 10x, 45x and oil immersion (i.e., 100x), objectives.

Photographs were taken using digital camera. Measurements of hyphae, basidia cystidia, setae, spores, cutis element etc. were taken using objective micrometer or calibrated occular Dimension of microscopic characters are given in micrometer (μm) eyepiece.

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## RESULTS AND DISCUSSION

Twenty one species of the *Phellins* were identified in the present study (Table 1). Among them seven species including *P. allardii*, *P. baumii*, *P. chaquensis*, *P. hippophaeicola*, *P. nilgheriensis*, *P. rhytiphloeus* and *P. setulosus* are new to India and Mahrashtra as well.

An artificial key was prepared, so as to distinguish between the collected species. For the segregation and assignment of correct taxonomic identity to the samples, keys of different authors viz., Ryvarden and Johansen (1980), Gilbertson and Ryvarden (1987) and Ryvarden (1995, 2000) were used as followed:

| | |
|---|---|
| 1 Hymenial setae present | 2 |
| 1' Hymenial setae absent | 7 |
| 2 Basidiospores becoming brown | 3 |
| 2' Basidiospores becoming yellow | 6 |
| 3 Pores/mm less than 8 | 4 |
| 3' Pores/mm more than 8 | 5 |
| 4 Basidiospores 4.5-6×4-5 um ovoid to subglobose | *P. linteus* |
| 4' Basidiospores 5-7×4-6 um subglobose to broadly elliptical | *P. setulosus* |
| 5 Basidiocarp imbricate | *P. chaquensis* |
| 5'Basidiocarp dimidiate | *P. calcitratus* |
| 6 Pores/mm less than 8 | *P. reichingeri* |
| 6' Pores/mm more than 8 | *P. baumii* |
| 7 Basidiospores becoming brown | 8 |
| 7'Basidiospores becoming yellow | 17 |
| 8 Basidiospores oval | 9 |
| 8'Basidiospores subglobose | 13 |
| 9 Pores/mm less than 8 | 10 |
| 9'Pores/mm more than 8 | 12 |
| 10 Basidiocarp tomentose | *P. badius* |
| 10'Basidiocarp hard woody | 11 |
| 11 Basidiocarp pendant | *P. acontextus* |
| 11'Basidiocarp ungulate | *P. grenadensis* |
| 12 Basidiocarp dimidiate | *P. allardii* |
| 12'Basidiocarp imbricate | *P. fastuosus* |
| 13 Pores/mm less than 8 | 14 |
| 13'Pores/mm more than 8 | 15 |
| 14 Basidiospores 5-6×4-5 μm | *P. merrilli* |
| 14'Basidiospores 5.0-6.2×5.0-6.0 μm | *P. offeatoporus* |

Table 1: *Phellinus* species, their host, collection locations and code

| *Phellinus* | Host | Location | Code |
|---|---|---|---|
| *P. acontextus* | *Gliricidia sepium* | Dapoli-Dabhol road | PH 346 |
| *P. adamantinus* | *Dalbergia melonoxylon, Casuarina equisetifolia, Delonix regia.* | Pune University, Empress park -Pune, Poultry trainee center- Pune | PH37, PH55, PH71 |
| *P. allardii* | Unknown, *Engenia jamboolana, Erythrina indica, Swietenia mahagani.* | F.C. road-Pune, Baneshwar, Anjrine | PH1, PH121, PH123, PH 425 |
| *P. aureobrunneus* | *Albeizzia lebbeck, Petrosperma petrocarpus* | Poultry trainee center-Pune, Anjrine | PH80, PH 397 |
| *P. badius* | *Delonix regia, Dalbergia melanoxylon* | Film Institute-Pune, Dabhol | PH 258, PH 358. |
| *P. baumii* | *Cassia* sp. | Karad | PH 194 |
| *P. calcitratus* | *Mangifera indica, Areca catechu, Mangifera indica.* | Anjrnie, Dapoli-Dabhol road, and Khed | PH342, PH408, PH405 |
| *P. chaquensis* | *Pongamia pinnata* | Saswad Road | PH139 |
| *P. coffeatoporus* | *Dalbergia melanoxylon* | Panshet | PH350 |
| *P. fastuosus* | *Mangifera indica,* Unkown tree, *Acacia nilotica, Atrocarpus heterophyllus, Albeizzia lebbeck, Tamaridus indica* | Anjrine, Dabhol, Karad, Kamla Nehru park- Pune, Lonawala, Pirangut. | PH 33, PH 41, PH 140, PH 203, PH 313, PH 354, PH 404. |
| *P. grenadensis* | *Azadirachata indica* | Kamla Nehru park | PH 314 |
| *P. hippophaeicola* | Unknown | Baneshwar | PH 124 |
| *P. linteus* | *Ficus benjamina, Mangifera indica, Areca catechu* | Pirangut, Dabhol, Dapoli-dabhol road Anjrine. | PH 231, PH232, PH 343, PH 400 |
| *P. merrillii* | *Gliricidia sepium* | Pune University | PH38 |
| *P. nilgheriensis* | *Bauhinia purpurea* | Anjrine | PH 399 |
| *P. pappianus* | *Caesalpinia coriuria* | Dabhol | PH352 |
| *P. pectinatus* | *Tamarindus indica, Dalbergia melonoxylon* | Dabhol | PH 107, PH 353 |
| *P. reichiningeri* | *Gliricidia sepium* | Karad | PH 145 |
| *P. resinaceus* | *Mangifera indica* | Sambhajipark | PH 299 |
| *P. rhytiphloeus* | *Atrocarpus heterophyllus, Azadirachata indica* | Poultry trainee center-Pune, Kamla Nehru park. | PH 73, PH 308 |
| *P. setulosus* | *Peltophoram petrocarpus* | Mulshi | PH151 |

| | |
|---|---|
| 15 Basidiocarp woody hard with several pilei confluent | *P. aureobrunneus* |
| 15'Basidiocarp tomentose | 16 |
| 16 Pore surface dark yellow brown to umber | *P. nilgheriensis* |
| 16'Pore surface dark brown | *P. rhytiphloeus* |
| 17 Basidiospores oval | 18 |
| 17'Basidiospores globose | 19 |
| 18 Pores/mm less than 6 | *P. resinaceous* |
| 18'Pores/mm more than 6 | *P. pappianus* |
| 19 Pores/mm less than 8 | *P. hippophaeicola* |
| 19'Pores/mm more than 8 | 20 |
| 20 Basidiospores 5×6.5 μm | *P. adamantinus* |
| 20'Basidiospores 4.5×4-5.5 μm | *P. pectinatus* |

**Description of the new species**

*Phellinus allardii* (Bres.) Ahmad, Monogr. Biol. Soc. Pakistan 6: 57. 1972.

Basidiocarp: 7-12×10×6 cm, pernnial, sessile, stipitate, solitary, imbricate, pileate, broadly attached, narrow attached, ungulate, semi circulate, not easily separable from the host. Upper Surface: Rough, sulcate, rounded, brown. Margin: lobed, rounded, 12 mm thick, layered, paler than surface. Pore surface: redish brown, pore: 8 per mm, angular. Tubes: 20 mm, stratified. Context: very thin, red brown. Hyphal system: Generative hyphae: simple septate, thin to slightly thick-walled, sometimes branched, 1.5-5.35 μm diam, Skeletal hyphae: thick-walled, golden to rusty brown, 2-6.24 μm diam. Conext hyphae: 2 um. Tubler hypahae: 3.57-3.72 μm. HypalSetae: absent. Basidia: clavate 4-sterigmate, 10-12×4-5 μm. Basidiospores: oval, thick-walled, pale rusty brown when mature, smooth, 6.2×5-35 μm.

*Phellinus baumii* Pilát. Bull. Soc. Mycolo. France 48: 25. 1932.

Basidiocarp: 5×5×3 cm, pernnial, sessile, imbricate, pileate, broadly attached, woody, ungulate, not easily separable from the host. Upper Surface: zonate, rough, dark brown. Margin: entired, sharp, 5 mm wide, layered, paler than surface. Pore surface: brown, pore: 10 per mm, rounded. Tubes: 2 mm. Context: hard woody, umber, 4 mm thick. Trama: 2 μm thick, golden yellow to golden ferruginous. Hypale setae: 10-25×5-6 μm. Basidia: 9.3×4.2 μm. Basidiospores: 3-3.2 μm in diameter, globose, hyaline to pale yellow.

*Phellinus chaquensis* (Iaconis *et* Wright). Wright *et* Desch. Mycotaxon 22: 416. 1984.

Basidiocarp: 18×11.5×10.6 cm, perennial, sessile, solitary, pileate, broadly attached, woody, ungulate, not easily separable from the host. Upper Surface: rough, rounded, rimose, brown. Margin: lobed, sharp, 1 mm thick, paler than surface. Pore surface: brown, pore: 6 per mm, angular, rounded. Tubes: 2 mm, stratified. Context: hard woody, sharp. Hyphal system: Contex hyphae: 5.35 μm. Tubler hyphae: 3.9. Hyphal septae: brown, 18.99×5.14 μm. Basidiospore: oval, brown, 6×5.2 m.

*Phellinus hippophaeicola* Jahn. Mem. New York bot. Gard. 28: 105. 1976.

Basidiocarp: 7×5×3 cm, pernnial, sessile, imbricate, pileate, broadly attached, woody, ungulate, not easily separable from the host. Upper Surface: Tomentose, sulcate, red brown to dark grey. Margin: Obtose and rounded. Pore surface: Cinnamon, rusty brown to deep brown. pore: 6 per mm, rounded. Tubes: 3 mm, stratified. Context: hard woody, rusty brown. Hyphal System: Generative hyphae: 3.2 μm. Hypal Seatae: absent. Context hypyhae: 5.35 μm. Tubler hyphae: 5.35 μm. Basidia: 10.2×12.95 μm, subglobose. Basidiospore: 5.35 μm, globose.

*Phellinus nilgheriensis* (Mont.) Cunn., New Zealland Dept. Sci. Ind. Res. Bull.164: 26. 1965.

Basidiocarp: 15×9.5×4-5 cm, pernnial, sessile, imbricate, pileate, narrow attached, woody, ungulate, not easily separable from the host. Upper Surface: Sulcate, rough, rounded, umber to blckish brown. Margin: entired, rounded. Pore surface: Dark yellow brown. pore: 8 per mm, rounded. Tubes: 20 mm, stratified. Context: hard woody, brown, <1 mm thick. Hyphal System: Generative hyphae: 2.7 μm. Context hypyhae: 4.14 μm. Tubler hyphae: 4.46 μm. Hypal Seatae: absent. Basidiospore: 5.39 μm, globose, thin walled, brown.

*Phellinus rhytiphloeus* (Mont.) Ryv. A preliminary polypore flora of East Africa: 206.1980.

Basidiocarp: 10×7.5×2.6 cm, perennial, pileate, applanate, solitary, narrow attached, woody hard, ungulate, not easily separable from the host. Upper Surface: glabrous and sulcate, rounded, dark brown. Margin: Rounded pale brown. Pore surface: Dark brown. pore: 7 per mm, angular. Tubes: 4 mm, stratified. Context: Bright with a silky luster, umber, 3-10 mm thick. Hyphal system: Generative hyphae: simple septate, 2.4 μm wide, Skeletal hyphae: thick-walled, golden-brown to rusty, 5-6.5 μm wide. Context hypyhae: 5.35 μm. Tubler hyphae: 5.35 μm. Hypal Seatae: absent. Hyphal Setae: absent. Basidiospors: globose, thick-walled, golden to rusty brown, 4.25 μm in diameter.

*Phellinus setulosus* (Lloyd) Imaz. Bull. Tokyo Sci. Mus. 6: 104. 1943.

Basidiocarp: 11.2×9×8 cm, perennial, sessile, solitary, pileate, narrow attached, woody, ungulate, not easily separable from the host. Upper Surface: Glabrous, rounded, yellow brown. Margin: Flavous, obtuselobed, rounded, 2 mm thick, layered, paler than surface. Pore surface: brown, pore: 7 per mm, rounded. Tubes: 2.5-10 mm, stratified. Context: hard woody, brown, 1 mm thick. Hyphal system: Generative hyphae: simple septate, 3.3 μm wide, Skeletal hyphae: thick-walled, golden-brown to rusty, 4.5 μm wide. Context hypyhae: 3.4 μm, Tubler hyphae: 3.93 μm. Hypal Seatae: brown, 24.99×7.14 μm. Basidiospors: oval, dark brown, 7×5 μm in diameter.

There is a close affinity in the floristic members of *Phellinus* in Maharashtra with that of Asian and African continents. The species of *Phellinus* might have arrived from early Mesozoic along with present day woody plants. The species may be considered as tropical northern distribution with the members of Asian and African floristic elements (Rabba, 1994).

The species collected from the regions of Maharashtra could be conveniently classified under following major categories:

- Northern tropical having affinities with that of Himalayan species namely *P. grenadensis*, *P. linteus* and *P. pectinatus*.
- Southern tropical having affinities with that of tropical Africa, Australia and America, *P. grenadensis*, *P. linteus*, *P. merrllii* and *P. pectinatus*.
- Arid species having affinities with either in the central peninsula of India or Afganisthan, Baluchisthan, Pakistan etc. The list of the species among these categories is *P. admatinus*, *P. fastuosus*, *P. merrllii* and *P. pectinatus*.

The species of *Phellinus* is looked on world wide basis species which are of mainly from central Africa namely *Phellinus adamantinus*, *P. fastuosus*, *P. grenadensis*, *P. linteus*, *P. merrillii* and *P. pectinatus*.

The species like *P. calcitratus* has affinities with that of tropical central America.

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