SUMMARY

1. A brief review of literature pertaining to natural resistance of various timber species to fungal decay, factors affecting decay resistance, scanning electron microscopic (SEM) studies of decayed wood, evaluation of wood preservatives and control of timber decay has been presented.

2. Experimental procedures followed and the materials used in this investigation have been described in detail under 'Materials and Methods'.

3. Logs of Dalbergia sissoo Roxb. (Sissoo) were collected with fructifications of *P. sanguineus* from Gadiakuthi forest of Jalpaiguri District of West Bengal. Similarly, logs with fructifications of either *C. hirsutus* or *F. flavus* were also collected from the same forest.

4. A generalised account of the basidiocarps of *P. sanguineus*, *C. hirsutus* and *F. flavus* based on several fruit-bodies collected from different localities of West Bengal has been presented.

5. Gross characters of the rots caused by the aforesaid fungi were studied in detail. Microscopic details (both light and scanning electron microscopy) of naturally and artificially decayed wood were also noted. Rupturing and thinning of cell walls, presence of bore holes in the walls, mycelial wefts in the lumina of vessels were of common occurrence in the wood during advanced stages of decay irrespective of the fungal species involved. Apparently *P. sanguineus* and *F. flavus* caused maximum and minimum decay of Sissoo wood respectively.
6. Scanning Electron Microscopic (SEM) studies reveal some abnormalities in decayed wood. Thinning and swelling of cell walls in some places, web-like network in vessels and distribution of hyphae in different wood elements were clearly visible. Several clear bore holes in cell walls were also noticed. All these structures were, however, absent in sound wood.

7. Microchemical tests showed the depletion of lignin from the walls of vessels, wood parenchyma and fibres but cellulosic materials were least affected.

8. Decay resistance test reveals that sapwood of *D. sissoo* is perishable (>30% decay) to all three test-fungi while the heartwood is resistant to *C. hirsutus* and *F. flavus* irrespective of rot isolates and polysporous mycelia, moderately resistant to resistant to *P. sanguineus* (4.08% loss in weight caused by rot isolates and 5.83% by polysporous mycelia). Polysporous mycelia have been found to be comparatively more destructive than their corresponding rot isolates in case of sapwood. But no significant difference was observed in % loss in weight of heartwood caused by two types of mycelia. Polysporous mycelia of *P. sanguineus* and *F. flavus* exhibited maximum (76%) and minimum (50%) decay of sapwood respectively.

9. It is evident from the "oxidase test" that all 3 test polypores belong to "white rot" group. Hence, they primarily attacked lignin. *P. sanguineus* and *C. hirsutus* showed oxidase reaction within 24 hours of inoculation in a malt agar medium containing either 0.5% tannic acid or 0.5% gallic acid. *F. flavus*, on the other hand, showed weak reaction only after 72 hours.

10. Sound sapwood of *D. sissoo* contains greater amount of
holocellulose (70.95%) than lignin (28.64%). *P. sanguineus* and *F. flavus* caused maximum (41.89%) and minimum (20.94%) amount of loss of lignin respectively. Degradation of holocellulose was negligible in all cases. Among 3 fungi *F. flavus* degraded more holocellulose.

11. Effect of interaction of 3 wood-rotting fungi on decay resistance of sapwood of Sissoo was studied *in vitro*. Loss in weight was only 32.22% when the sapwood was exposed to both *P. sanguineus* and *C. hirsutus* (PxC) but *P. sanguineus* (PxP) or *C. hirsutus* (CxC) alone caused 72.18% and 69.12% decay respectively.

12. Percentage loss in weight of sapwood was minimum (24.28%) when exposed to both *P. sanguineus* and *F. flavus* (PxP) but *P. sanguineus* (PxP) or *F. flavus* (FxP) alone caused 72.18% and 57.74% decay respectively. Reduction in decay was due to antagonism between the two fungal species.

13. *C. hirsutus* (CxC) and *F. flavus* (FxP) showed 69.62% and 57.74% decay respectively but they (CxF) jointly caused 70.32% decay.

14. Results of pairing experiment on solid medium reveal that *P. sanguineus* and *F. flavus* (PxF) are antagonistic to each other. Similarly, *P. sanguineus* and *C. hirsutus* (PxC) are also antagonistic.

15. *P. sanguineus* and *F. flavus* (PxP) showed minimum mycelial growth (63 mg) when they were grown together in a liquid medium. *P. sanguineus* (PxP) or *F. flavus* (FxP) alone exhibited 153.33 mg and 104 mg growth respectively.
16. Growth of *C. hirsutus* (CxC) alone was 111.67 mg but in combination with *P. sanguineus* it was 78.33 mg.

17. Preferential utilization of nitrogen by 3 test fungi was also recorded. Yeast extract was the best source of nitrogen for all. Growth of *C. hirsutus* was maximum among the three fungi. Of the four concentrations (0.1%, 0.5%, 1.0%, 1.5%) of asparagine, 1.0% was most favourable for growth of both *P. sanguineus* and *F. flavus* while 0.5% was suitable for *C. hirsutus*. *P. sanguineus* utilised maximum nitrogen (source - Asparagine) from the medium than the other two fungi. This conclusion is based on the percentage increase in relation to control.

18. Aqueous heartwood extractive was more fungitoxic than aqueous sapwood extractive. Heartwood extractive was most toxic to *F. flavus* (73% reduction in relation to its control) and least (51%) to *P. sanguineus*.

19. Fungitoxicity decreased after removal of diethyl ether solubles from heartwood extractive. *P. sanguineus*, *F. flavus* and *C. hirsutus* showed 24.62%, 21.98% and 28.12% reduction in mycelial growth respectively.

20. The resistance of sapwood decreased markedly after removal of diethyl ether solubles but the same wood regained its resistance partially when the heartwood extractive was supplemented to it. This diethyl ether extractive was more or less equally toxic to *P. sanguineus* and *C. hirsutus* (27.24% and 28% reduction in relation to control) and least (23.83%) to *F. flavus*. Fungitoxic substance is more soluble in diethyl ether than in water.
21. Besides diethyl ether extractive, fungitoxicity was also detected in ethanol, methanol and petroleum ether extractives of wood.

22. The fungitoxic substance was isolated from ethanol extractive by preparative TLC (Rf = 0.91). Fungitoxicity of the substance was confirmed by Petridish bioassay test using test fungi.

23. The antifungal substance (active principle) reacted with Ferric chloride and Potassium ferricyanide. The UV-absorption spectrum of the compound was found to be 258 nm.

24. Five water soluble preservatives were tested (using wood blocks) of which Ascu-A was most effective in controlling decay. Between 2 water repellent preservatives (viz. PS-2, creosote), creosote was better. About 90% control in decay (in relation to control) was recorded in all cases.

25. Effectiveness of creosote was also tested in the field following impregnation method. This wood preservative effectively controlled fungal decay (30-40% reduction in decay in relation to control) of wood (billets).