

## **OCCURRENCE OF WOOD INHABITING FUNGI IN FORESTS OF PENINSULAR MALAYSIA**

**Salmiah Ujang**

*Forest Research Institute Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia*

**&**

**E. B. G. Jones**

*National Center for Genetic Engineering and Biotechnology (BIOTEC) NSTDA, Bangkok 10400, Thailand*

*Received February 2000*

---

**SALMIAH, U. & JONES, E. B. G. 2001. Occurrence of wood inhabiting fungi in forests of Peninsular Malaysia.** This study investigated species diversity and frequency of occurrence of the wood inhabiting fungi from various forest reserves and plantation forests in Peninsular Malaysia. A total of 327 sightings/collections assigned to 52 species were recorded. More fungal species were collected in forest reserves compared to plantation forests. The site at Pasoh Forest Reserve had the highest diversity of wood inhabiting mycota (29 species) and also species richness.

Key words: Tropical fungi - diversity - occurrence frequency - forest reserves - plantation forests

**SALMIAH, U. & JONES, E. B. G. 2001. Kemunculan kulat yang hidup pada kayu di hutan-hutan Semenanjung Malaysia.** Penyelidikan telah dijalankan ke atas kepelbagaian spesies dan kekerapan munculnya kulat yang hidup pada kayu dari beberapa hutan simpan dan hutan ladang di Semenanjung Malaysia. Sejumlah 327 kulat yang tergolong dalam 52 spesies telah direkodkan. Lebih banyak spesies kulat didapati dan dipungut di hutan simpan berbanding dengan hutan ladang. Hutan Simpan Pasoh mengandungi kepelbagaian mikota kulat kayu (29 spesies) dan kekayaan spesies kulat yang paling tinggi.

### **Introduction**

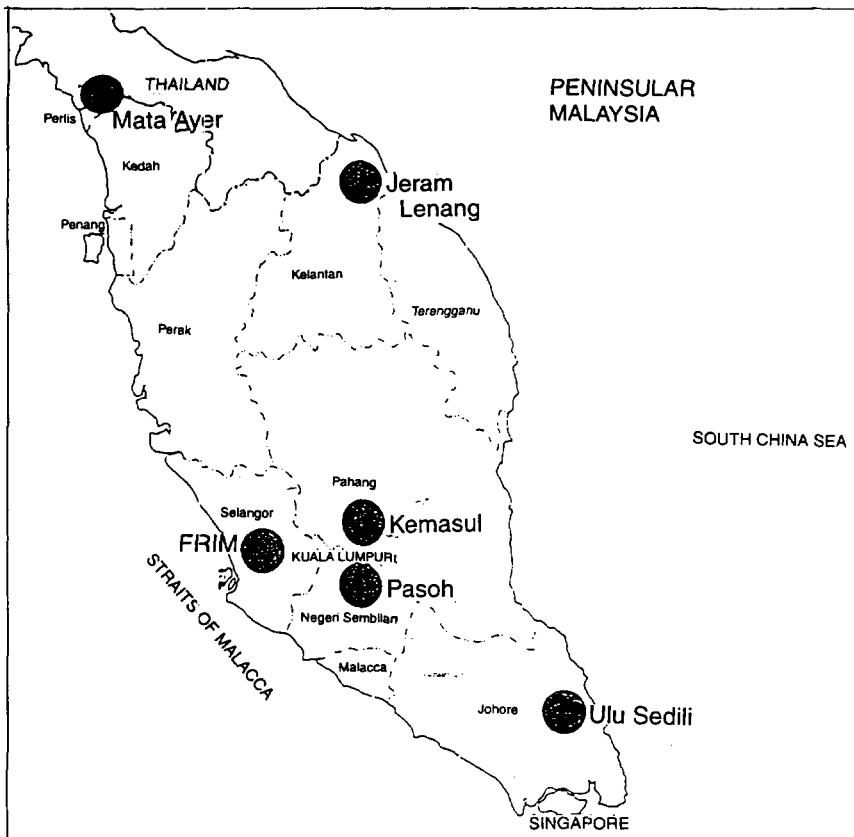
Fungi are equally as important in the biodiversity of forests as are plants and animals. Pegler (1997) referred to fungi as “managers of the forests” as they are important decomposers of dead organic material, recycling nutrients and essential elements through litter decomposition or through pathogenicity of forest trees. Based on a report on the alarming rate at which the tropical rain forest is disappearing (Myers 1980), there is little doubt that many tropical fungi are disappearing before they could be discovered and identified. Thus the documentation of fungi present in the ecosystem before the habitat is lost forever becomes an important task. Complete knowledge of fungi requires continuous observation and collection over many years; a difficult, if not impossible, task in the tropics. Species of macrofungi may be classified as threatened when there is a significant decrease in the number of basidiomes (fruiting bodies) over a large area, which can indicate reduced dispersal capacity of

species. The present study investigates the diversity of wood inhabiting fungi and their frequency of occurrence at six forest locations in Peninsular Malaysia.

### Materials and methods

Three forest reserves (lowland mixed dipterocarp forests) at the Forest Research Institute Malaysia (FRIM), Pasoh and Jeram Lenang were chosen for this study, along with three plantation forests at Kemasul (*Acacia mangium*), Ulu Sedili (*A. mangium*) and Mata Ayer (teak) (Figure 1). All sites were visited twice (four to five days per visit) between January and August 1993 and occurrence of basidiomes was noted. Species were defined as “abundant” (> 10 sightings/collections from the same site), “frequent” (5–10) and “not frequent” (< 5). Determination of the occurrence of fungi was based on the presence of their basidiomes in the forests. The number of basidiomes was determined based on each colonised log, which was counted as a single occurrence. The whole forest area, including paths and roadsides, was methodically searched for basidiomes. Voucher specimens were dried and kept in the Wood Mycology Laboratory, FRIM.

Direct comparisons between forest stands and the basis of fungal species were used to assess their similarity. Jaccard and Sovenson’s similarity indices were used to compare the species composition between any two forest locations.



**Figure 1.** Map of Peninsular Malaysia showing the sites from which wood inhabiting fungi were collected

## Results and discussion

*Pycnoporus sanguineus*, *Microporus xanthopus* and *Schizophyllum commune* were the most frequently found fungi and occurred on more than 40 occasions at the six different sites. *Lenzites elegans* was encountered 23 times, mostly on fallen logs and with mature spore producing basidiomes. *Earliella scabrosa* occurred 17 times, 5 times on fallen logs and 12 times on large branches. *Trametes feei* was found 14 times mainly in open areas. The abundance of these six species was not surprising since Ryvar den and Johansen (1980) stated that they are very common and widely distributed in tropical countries. This observation was confirmed by Kuthubutheen (1981) and Pegler (1983) who, in addition, reported *S. commune* as a common and frequently encountered saprophyte on fallen wood. In this study only three species of *Ganoderma*, namely, *G. australe*, *G. lucidum complex* and *G. applanatum* were recorded.

The first visit to FRIM was made in January 1993, a week after a rainy season and the second in June 1993, during a dry period. One hundred and eleven samples were recorded, comprising 26 species of which 15.4% were abundant, 23.1% frequent and 61.5% not frequent (Table 1). The four species considered as abundant were

**Table 1.** Abundance of wood inhabiting fungi at the Forest Research Institute Malaysia (FRIM)

Frequency	Fungus	Abundance (n)
Abundant (> 10 sightings/collections)	<i>Schizophyllum commune</i> Fr.	15
	<i>Pycnoporus sanguineus</i> (Fr.) Murr	14
	<i>Microporus xanthopus</i> (Fr.) Kuntze	12
	<i>Lentinus sajor-caju</i> (Fr.) Fr.	11
Frequent (5–10 sightings/collections)	<i>Microporus affinis</i> (Bl. & Nees: Fr.) Kuntze	8
	<i>Pleurotus djamor</i> (Fr.) Boedijn	8
	<i>Earliella scabrosa</i> (Pers.) Gilb. & Ryv.	6
	<i>Trametes feei</i> (Fr.) Pat.	6
	<i>Lentinus strigosus</i> (Schw.) Fr.	5
	<i>Lenzites elegans</i> (Spreng.: Fr.) Pat.	5
Not frequent (< 5 sightings/collections)	<i>Coriolopsis retropicta</i> (Lloyd) Teng	3
	<i>Lentinus squarrosulus</i> Mont.	2
	<i>Trametes villosa</i> (Fr.) Kreisel	2
	<i>Polyporus dictyopus</i> Mont.	2
	<i>Amauroderma rugosum</i> (Bl. & Nees) Torrend	1
	<i>Ganoderma applanatum</i> (Pers. Ex Wallr.) Pat	1
	<i>Gymnopilus</i> sp.	1
	<i>Hexagonia tenuis</i> (Hook.) Fr.	1
	<i>Lentinus polychrous</i> Lev.	1
	<i>Lenzites vespacea</i> (Pers.) Ryv.	1
	<i>Nigroporus vinosus</i> (Berk.) Murr.	1
	<i>Polyporus grammocephalus</i> Berk.	1
	<i>Stereum ostrea</i> (Bl. & Nees) Fr.	1
	<i>Trametes</i> sp.	1
	<i>Trametes menziesii</i> (Berk.) Ryv.	1
<i>Trametes modesta</i> (Fr.) Ryv.	1	
Number of species (S)		26
Total individual specimens sighted/collected (N)		111

*P. sanguineus*, *M. xanthopus*, *S. commune* and *Lentinus sajor-caju*. These four species plus *Pleurotus djamor* and *M. affinis* were collected during the two visits. The remaining fungi were found only during one of the visits, which may suggest that they have restricted fruiting ability.

*Trametes* was observed to be the most frequently occurring genus throughout the grounds of FRIM. *Pycnoporus sanguineus*, *S. commune*, *L. sajor-caju*, *G. applanatum*, *T. feei* and *T. villosa* were recorded from old and decayed logs. *Microporus xanthopus* occurred in abundance on fallen twigs and branches of the trees in the arboretum.

Pasoh Forest Reserve was visited in the months of January and June 1993. During both visits the forest floor was wet following several days of rain. A total of 51 samples comprising 29 species were recorded: 3.4% were abundant, 3.4% were frequent while 93.1% were categorised as not frequent (Table 2). *Microporus xanthopus* basidiomes

**Table 2.** Abundance of wood inhabiting fungi in Pasoh Forest Reserve

Frequency	Fungus	Abundance (n)
Abundant (> 10 sightings/collection)	<i>Microporus xanthopus</i>	11
Frequent (5-10 sightings/collection)	<i>Microporus affinis</i>	5
Not frequent (< 5 sightings/collection)	<i>Eartiella scalbrosa</i>	2
	<i>Tyromyces nemorosus</i> Corner	2
	<i>Flavodon flavus</i> (Kl.) Ryr.	2
	<i>Ganoderma australe</i> (Fr.) Pat.	2
	<i>Lenzites elegans</i>	2
	<i>Pycnoporus sanguineus</i>	2
	<i>Schizophyllum commune</i>	2
	<i>Trametes feei</i>	2
	<i>Amauroderma rugosum</i>	1
	<i>Corioloopsis</i> sp.	1
	<i>Corioloopsis retroflecta</i> (Lloyd) Teng	1
	<i>Ganoderma applanatum</i>	1
	<i>Gymnopilus</i> sp.	1
	<i>Gyrodontium versicolor</i> (Berk. & Br.) Maas. G.	1
	<i>Hexagonia tenuis</i> (Hook.) Fr.	1
	<i>Lenzites acuta</i> Berk.	1
	<i>Nigroporus vinosus</i>	1
	<i>Phellinus lamaensis</i> (Murr.) Heim	1
	<i>Phellinus noxius</i> Corner	1
	<i>Piptoporus soloniensis</i>	1
	<i>Polyporus dictyopus</i>	1
	<i>Polyporus hirsutus</i> Corner	1
	<i>Poria</i> sp.	1
	<i>Pyroformes</i> sp.	1
	<i>Tinctoporellus epimilinus</i>	1
	<i>Trametes villosa</i>	1
	<i>Trichaptum biforme</i> (Fr.) Ryv.	1
Number of species (S)		29
Total individual specimens sighted/collected (N)		51

were found in abundance on fallen twigs and branches along the forest trail and were recorded 11 times during the two visits. The only frequent species, *M. affinis*, was recorded five times in each of the visit. *Microporus* was found to be the dominant genus in Pasoh. Although fewer fungi were recorded at this site compared to at FRIM, there appeared to be greater diversity of species. *Pycnoporus sanguineus* was found in abundance on a fallen tree trunk at the entrance of the forest trail and again on another log near the roadside during the second visit.

The site at Jeram Lenang Forest Reserve was visited in April and July 1993. April was drier and July was wetter than average for this area. Fifty-five collections assigned to 23 species were recorded (Table 3). Similar numbers of fungi were recorded at each collection site, 11 species during the first visit and 12 species during the second. A total of 19 not frequent species were encountered. *Rigidoporus microporus* with orange-yellow basidiomes was recorded five times during the two visits.

Kemasul plantation forest was visited in February and June 1993. Thirty-eight samples assigned to 18 species were recorded (Table 4); no species were recorded as abundant, only 3 species (16.7%) were frequent while 15 species were categorised as not frequent. Eleven species were collected during the second visit, two weeks after a

**Table 3.** Abundance of wood inhabiting fungi in Jeram Lenang Forest Reserve

Frequency	Fungus	Abundance (n)
Abundant (> 10 sightings/collections)	<i>Microporus xanthopus</i>	12
Frequent (5–10 sightings/collections)	<i>Pycnoporus sanguineus</i>	7
	<i>Rigidoporus microporus</i> (Fr.) v. Ov.	5
	<i>Schizophyllum commune</i>	6
Not frequent (< 5 sightings/collections)	<i>Lenzites elegans</i>	3
	<i>Stereum ostrea</i>	2
	<i>Earliella scabrosa</i>	2
	<i>Trametes feei</i>	2
	<i>Lentinus sajor-caju</i>	2
	<i>Lentinus strigosus</i>	1
	<i>Lenzites acuta</i>	1
	<i>Lenzites flaccida</i> (Bull.) Fr.	1
	<i>Microporellus inusitatus</i> (Lloyd) Corner	1
	<i>Nigroporus vinosus</i>	1
	<i>Phellinus umbinellus</i>	1
	<i>Pleurotus djamor</i>	1
	<i>Polyporus dictyopus</i>	1
	<i>Polyporus grammacephalus</i>	1
	<i>Polyporus hirsutus</i>	1
	<i>Amuroderma rugosum</i>	1
	<i>Trametes carneo-nigra</i> (Berk.) Corner	1
	<i>Trametes insularis</i>	1
	<i>Tyromyces nemorosus</i> Corner	1
Number of species (S)		23
Total individual specimens sighted/collected (N)		55

**Table 4.** Abundance of wood inhabiting fungi at *Acacia mangium* plantation forest in Kemasul

Frequency	Fungus	Abundance (n)
Abundant (> 10 sightings/collections)	Not available	0
Frequent (5–10 sightings/collections)	<i>Pycnoporus sanguineus</i>	6
	<i>Lenzites elegans</i>	6
	<i>Lenzites acuta</i> Berk.	5
Not frequent (< 5 sightings/collections)	<i>Earliella scabrosa</i>	3
	<i>Microporus xanthopus</i>	3
	<i>Lentinus sajor-caju</i>	2
	<i>Schizophyllum commune</i>	2
	<i>Amauroderma rugosum</i>	1
	<i>Ganoderma lucidum</i> (Leys) Karst	1
	<i>Gloeophyllum striatum</i> (Fr.) Murr	1
	<i>Lentinus squarrosulus</i> Mont.	1
	<i>Lentinus strigosus</i> (Schw.) Fr.	1
	<i>Nigroporus vinosus</i> (Berk.) Murr	1
	<i>Phellinus</i> sp.	1
	<i>Phellinus sublinteus</i>	1
	<i>Trametes feii</i> (Fr.) Pat.	1
	<i>Trametes corrugata</i> (Pers.) Bres.	1
	<i>Trametes menziesii</i> (Berk.) Ryv.	1
Number of species (S)		18
Total individual specimens sighted/collected (N)		38

period of rain. This was in contrast with only seven species collected during the first visit when the forest floor was drier. *Lentinus* spp., which normally occur gregariously, were represented by only a few basidiomes while *Gloeophyllum striatum* was encountered only on a dry log in an open area near the roadside.

Fungal collections at Mata Ayer were made in February and July 1993. Both visits were made after the wet season. Twenty-one fungi consisting of 10 species were recorded during the two visits (Table 5). Only two frequent species were recorded, *Lenzites elegans* and *P. sanguineus*. Meanwhile eight species were in the not frequent group, with five of these occurring only once during the two visits. *Earliella scabrosa* basidiomes were found to be very old and dry whereas *T. feii* was in a young, immature stage. Fungal diversity was poor here despite the moist forest floor.

The two collecting trips at Ulu Sedili plantation forest were undertaken in March and June 1993, both during a dry period. A total of 51 samples comprising 15 species were recorded (Table 6). Eleven of these species (73.3%) were categorised as not frequent, nine of which were recorded during the second visit. *Schizophyllum commune*, a common wood saprotroph, thrives on fallen branches and trunks and was the only species found in abundance. *Ganoderma australe* was frequently encountered on standing decayed *A. mangium* trunks.

A total of 52 species assigned to 29 genera was recorded from all the six sites. Twenty-three of these species occurred only once at any one particular site. There were fewer species of wood inhabiting fungi recorded from the plantation forests compared to the forest reserves. The largest number of species (29 species) was

**Table 5.** Abundance of wood inhabiting fungi in the teak plantation forest in Mata Ayer, Perlis

Frequency	Fungus	Abundance (n)
Abundant (> 10 sightings/collections)	Not available	0
Frequent (5–10 sightings/collections)	<i>Lenzites elegans</i>	5
	<i>Pycnoporus sanguineus</i>	5
Not frequent (< 5 sightings/collections)	<i>Microporus xanthopus</i>	2
	<i>Lentinus polychrous</i> Lev.	2
	<i>Schizophyllum commune</i>	2
	<i>Earliella scabrosa</i>	1
	<i>Microporus affinis</i>	1
	<i>Trametes feei</i>	1
	<i>Trametes modesta</i> (Fr.) Ryv.	1
	<i>Trametes pocus</i> (Berk.) Ryv.	1
Number of species (S)		10
Total individual specimens sighted/collected (N)		21

**Table 6.** Abundance of wood inhabiting fungi in *A. mangium* plantation in Ulu Sedili

Frequency	Fungus	Abundance (n)
Abundant (> 10 sightings/collections)	<i>Schizophyllum commune</i>	15
Frequent (5–10 sightings/collections)	<i>Pycnoporus sanguineus</i>	6
	<i>Ganoderma australe</i>	5
	<i>Microporus affinis</i>	5
Not frequent (< 5 sightings/collections)	<i>Earliella scabrosa</i>	3
	<i>Trametes socotrana</i>	3
	<i>Trametes feei</i>	2
	<i>Trametes modesta</i> (Fr.) Ryv.	2
	<i>Lentinus sajor-caju</i>	2
	<i>Lenzites elegans</i>	2
	<i>Microporus xanthopus</i>	2
	<i>Antrodia</i> sp.	1
	<i>Trichaptum biforme</i> (Fr.) Ryv.	1
	<i>Lentinus squarrosulus</i> Mont.	1
	<i>Hexagonia apiaria</i> Pers.	1
Number of species (S)		15
Total individual specimens sighted/collected (N)		51

sighted/collected at Pasoh and the lowest number was sighted/collected at Mata Ayer (10 species).

Pasoh showed a greater species diversity with 29 species while 26, 23, 18, 15 and 10 species were collected at FRIM, Jeram Lenang, Kemasul, Ulu Sedili and Mata Ayer forests respectively. Similarity of species composition between two collecting sites was compared by using the Jaccard and Sorenson similarity indices (Table 7). Almost

**Table 7.** Similarity indices of species composition between forest stands

	FRIM	Pasoh	Jeram Lenang	Kemasul	Mata Ayer	Ulu Sedili
FRIM	A	0.58	0.54	0.46	0.35	0.38
Pasoh	0.73		0.34	0.31	0.24	0.31
Jeram Lenang	0.70	0.47		0.61	0.60	0.30
Kemasul	0.63	0.47	0.76		0.33	0.44
Mata Ayer	0.53	0.39	0.75	0.50		0.70
Ulu Sedili	0.50	0.51	0.46	0.61	0.82	B

A: Jaccard similarity, B: Sorenson similarity

equivalent similarity was observed in species composition at FRIM and Pasoh (Jaccard 0.58, Sorenson 0.73) when compared to FRIM and Jeram Lenang (Jaccard 0.54, Sorenson 0.70) forest reserves. At the plantation forests, there was greater similarity in species composition at Ulu Sedili and Mata Ayer (Jaccard 0.70, Sorenson 0.82) compared to Ulu Sedili and Kemasul (Jaccard 0.44, Sorenson 0.61). In comparison between forest reserves and plantation forests, there was more similarity in species composition between FRIM Forest Reserve and *A. mangium* plantation forest at Kemasul and less similarity between Pasoh Forest Reserve and teak plantation forest at Mata Ayer.

Diversity indices of the wood decay fungi at the six collecting sites are listed in Table 8. Species richness, measured by Margalef and Menhinick indices showed that Pasoh Forest Reserve had the highest diversity of wood decay mycota (Margalef 7.1, Menhinick 4.1), followed by FRIM, Jeram Lenang, Kemasul, Mata Ayer and Ulu Sedili.

**Table 8.** Diversity of wood decay fungi at the selected collecting sites

Diversity index	FRIM	Pasoh	Jeram Lenang	Kemasul	Mata Ayer	Ulu Sedili
Species richness	26	29	23	18	10	15
Individual (N)	111	51	55	38	21	51
Margalef	5.3	7.1	3.6	4.7	3.0	5.5
Menhinick	2.5	4.1	3.1	2.9	2.2	2.1

From the present study it was apparent that some wood decay fungi occurred on a wide range of woody substrata which included twigs, branches and trunks. Fungi which grew on fallen trunks of *A. mangium* and teak in plantation forests were also found to exist on other fallen logs at forest reserves. Common fungi on *A. mangium* in Kemasul and Ulu Sedili were *S. commune*, *P. sanguineus*, *E. scabrosa*, *T. feei*, *L. elegans*, *Lentinus sajor-caju* and *L. squarrosulus*.

The differences in the abundance and occurrence of wood-inhabiting fungi in this study can be attributed to several factors such as rainfall, quantities of suitable substrata, damp forests with constant high air humidity and type of forests. Moisture content and aeration were reported by Cooke and Rayner (1984) to be potent determinants of the occurrence, distribution and activity of fungi in felled or fallen timber. Studies on rainfall affecting seasonality of basidiome production in Malaysia have only been recorded for agarics (Corner 1935, Watling 1994). This is an indication that some fungi involved in wood decay are seasonally affected by rainfall, which possibly modify the water potential of fallen wood. The production of basidiomes



requires a supply of water and this can be the factor which determines their occurrence and frequency. There may be long periods when no basidiomes were apparent and we thought they were absent. For instance, only one third of the total species were sighted on the first visit to Kemasul because of the dry season and the other two-thirds were sighted when the forest floor was wet, subsequent to a period of rain. The stimulus of fruiting can be revived by heavy and prolonged rain.

The low number of wood inhabiting fungi recorded in this study could be due to the fact that only two collecting visits were made to each of these sites. More frequent visits, will increase the number of sampling units (logs) and longer observation period might have resulted in both greater species diversity and higher frequencies of occurrence. This hypothesis is supported by the findings of Corner (1983, 1989, 1991) who showed that species diversity and occurrence increased with increasing number of visits over a longer period.

### Conclusion

A total of 327 collections assigned to 52 species were recorded in selected forests of Peninsular Malaysia in a period of eight months. Based on the observation, more species of wood inhabiting fungi were collected in forest reserves compared to plantation forests.

### Acknowledgements

We are grateful to FRIM for providing facilities and financial support for this study. Many thanks to S. Moss, Mohd Dahlan Jantan and Abdul Latif Mohmod for their valuable comments and especially to P. Thillainathan for his technical assistance.

### References

- COOKE, R. C. & RAYNER, A. D. M. 1984. *Ecology of saprotrophic fungi*. Longman Inc., New York. 415 pp.
- CORNER, E. J. H. 1935. The seasonal fruiting of *Agaricus* in Malaya. *Gardens Bulletin of the Settlement* 9: 79–88.
- CORNER, E. J. H. 1983. Ad-Polyporaceas I. *Amauroderma* and *Ganoderma*. *Beiheft Nova Hedwigia* 75. 182 pp.
- CORNER, E. J. H. 1989. Ad-Polyporaceas VI. *Beiheft Nova Hedwigia* 97. 197 pp.
- CORNER, E. J. H. 1991. Ad-Polyporaceas VII. *Beiheft Nova Hedwigia* 101. 175 pp.
- KUTHUBUTHEEN, A. J. 1981. Notes on the macrofungi of Langkawi. *Malayan Nature Journal* 34: 123–130.
- MYERS, N. 1980. *Conservation of Tropical Moist Forest*. National Academy of Sciences, Washington. 40 pp.
- PEGLER, D. N. 1983. The genus *Lentinus* – a world monograph. *Kew Bulletin Additional Series* 10. 281 pp.
- PEGLER, D. N. 1997. *The larger fungi of Borneo*. Natural History Publications, Kota Kinabalu. 91 pp.
- RVARDEN, L. & JOHANSEN, I. 1980. *A preliminary polypore flora of East Africa*. Fungiflora, Oslo, Norway. 636 pp.
- WATLING, R. 1994. A Malaysian fungus foray. *Mycologist* 8: 179–180.