CHAPTER IV

RESULTS AND DISCUSSION

TEMPERATURE AND RELATIVE HUMIDITY

ATMOSPHERIC TEMPERATURE

The annual temperature data in the Western Hall are shown in Figure 4.1. The average annual temperature at the well-ventilated area (P3) was 29.3°C the minimum and maximum of 25.3°C and 33.8°C. The average temperature in summer (February-May) was 29.6°C, rainy season (June-September) was 29.5°C, and winter (October-January) was 28.8°C.

Seasonal differences between the temperature for each season are apparent. It seems likely that the temperature in rainy season is higher than those in winter and is highest in summer. The data were tested in statistical difference by t-test for mean at 95% confidence (Appendix B). The difference found existing between summer and winter, and rainy season and winter ($p<0.05$) while there was no statistical significant difference between summer and rainy season.

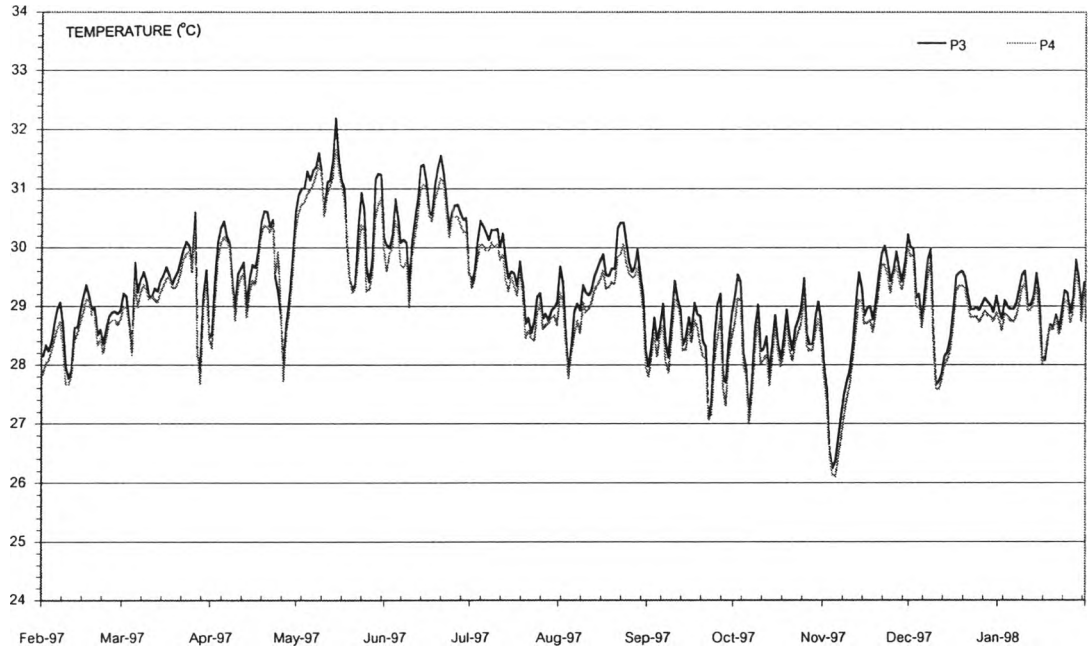

Figure 4.1: Annual temperature in the Western Hall.

At the poor-ventilated area (P4), the average annual temperature was 29.1°C (between 25.4°C and 32.3°C). The average temperature in summer, rainy season and winter were found to be 29.4°C, 29.3°C, and 28.6°C, respectively. The temperature in summer was no significantly higher than those in rainy season but it was significantly higher than those in winter ($p<0.05$).

Furthermore, the temperature at two areas were significantly different ($p<0.05$).

ATMOSPHERIC RELATIVE HUMIDITY

The data on relative humidity detected are shown in Figure 4.2. The mean relative humidity (RH) at P3 was 71.1%, with extremes of 31.6% and 95.4%. Average relative humidity was highest over 80% in rainy season, especially in September. The average lowest RH value, around 66.1%, was recorded in January.

The results showed that high RH (70-90%) persisted in rainy season while winter showed moderate RH (60-80%) and in summer, it was 50-70%. The average RH in summer was around 69.0%, in rainy season was around 72.8%, and in winter was around 71.6%.

The RH was no significantly different between rainy season and winter while it was significant between rainy season and summer, and winter and summer ($p<0.05$).

The average RH of P4 was 71.8%, with extremes of 34.4% and 96.3%. In rainy season, the RH was around 74.0% while in summer was around 69.2% and in winter was 72.2%.

The RH in rainy season was no significantly higher than those in winter but it was significantly higher than those in summer ($p<0.05$).

In addition, the RH of P4 was significantly higher than those of P3 ($p<0.05$).

The seasonal climatic data are shown in Figure 4.3 to Figure 4.5. In each season, the trend lines of temperature at P4 were lower than P3 but those of RH at P4 were higher than P3.

The results of the present study give support for the hypothesis that the temperature and relative humidity were difference between the well-ventilated area and the poor-ventilated area in this Hall. Thus, there are microclimates in each area of the room and may affect the abundance of fungi.

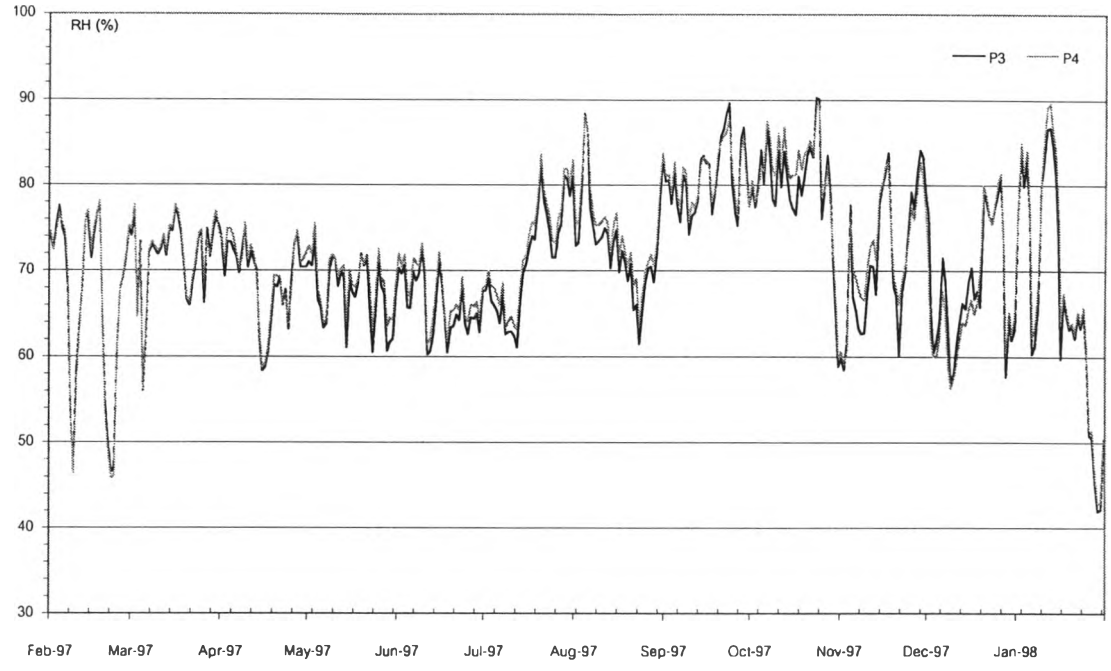

Figure 4.2: Annual relative humidity in the Western Hall.

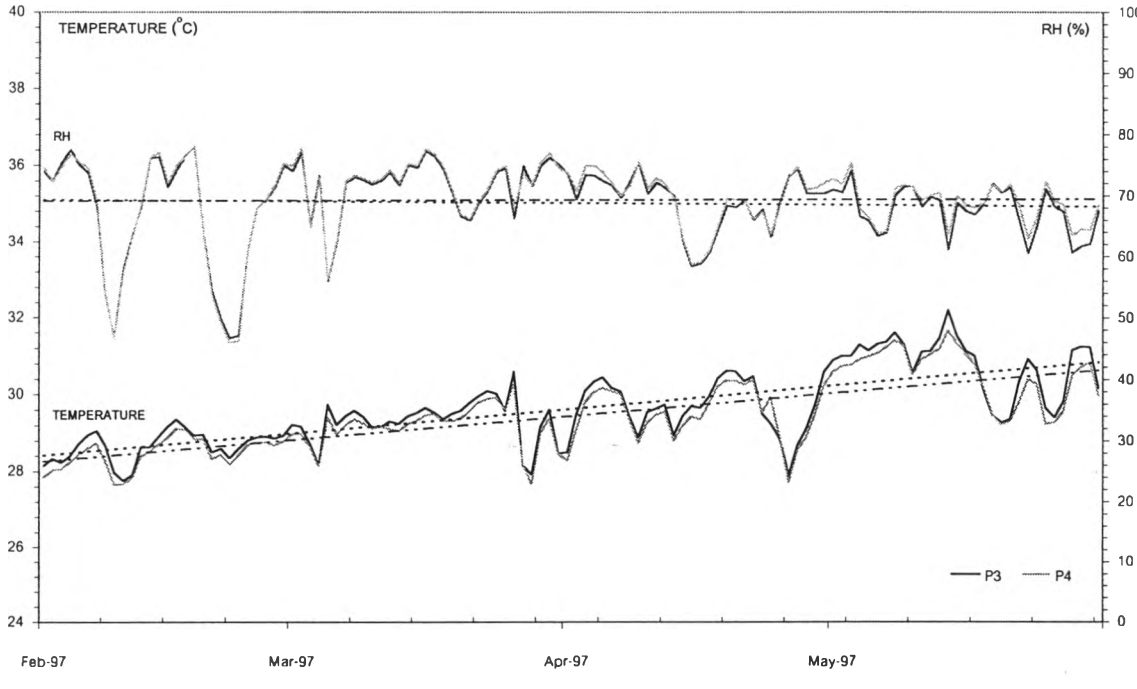

Figure 4.3: Climatic data in summer.

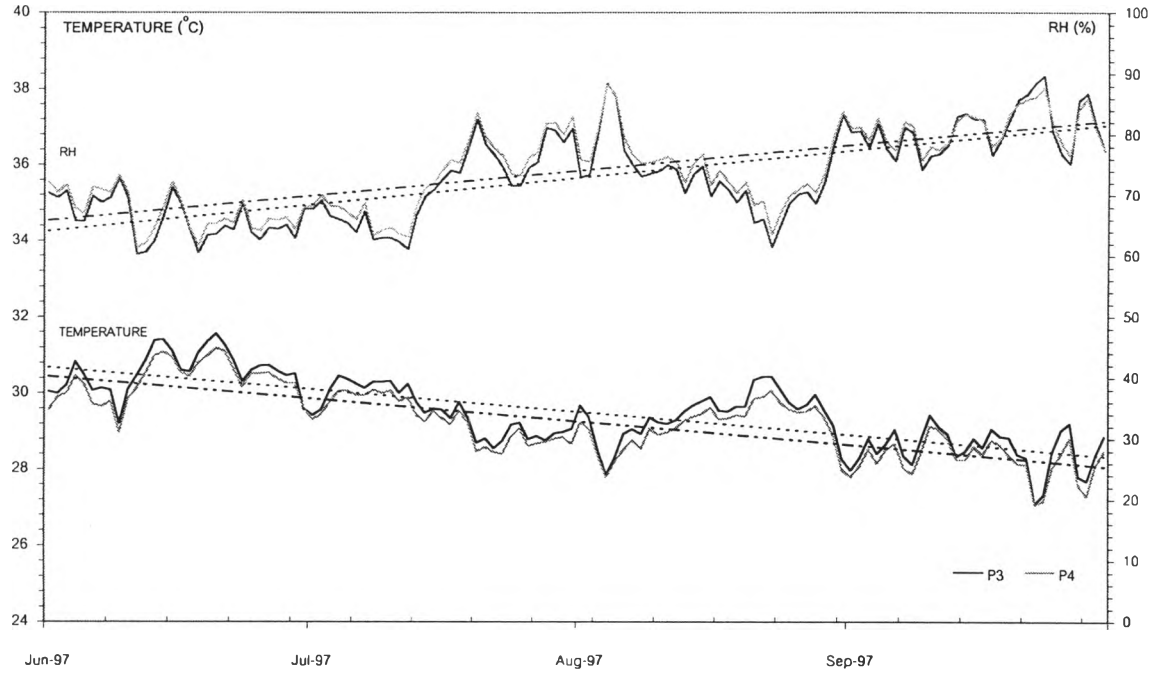

Figure 4.4: Climatic data in rainy season.

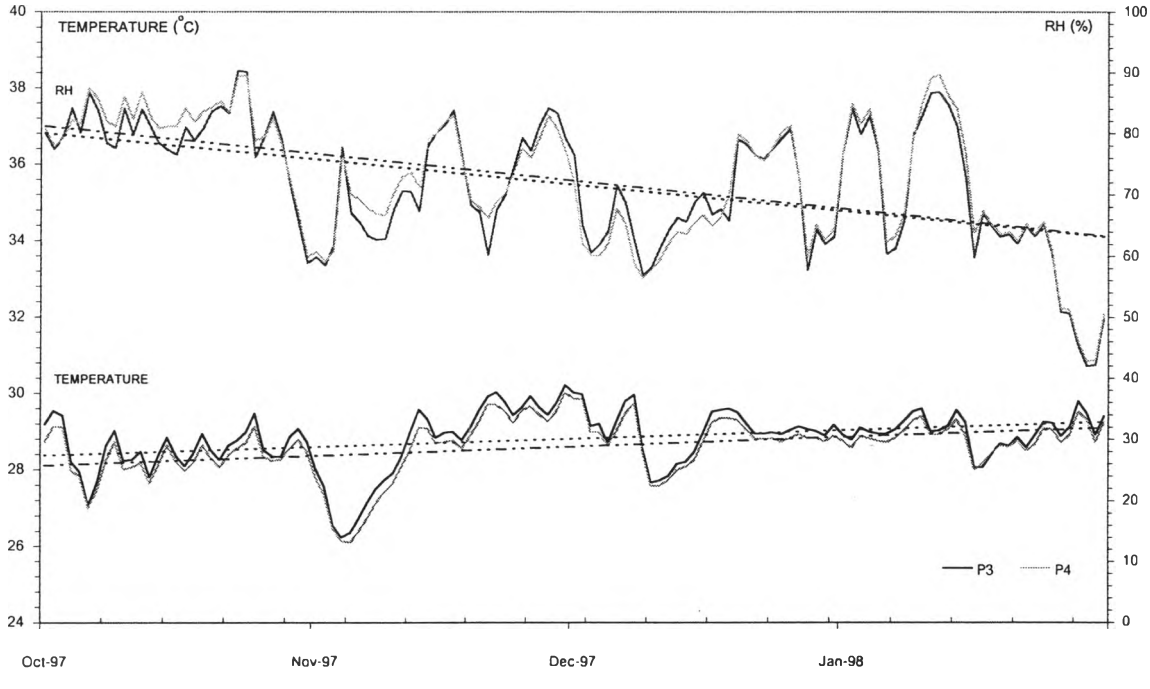

Figure 4.5: Climatic data in winter.

FUNGI

Many different kinds of fungi were found in the atmosphere during the entire year. The concentration of the total airborne fungi is shown in Table 4.1 and is graphically presented in Figure 4.6. The line in graph is the average concentration of every point in the Hall. In the present study, a total of 13 genera were isolated in the Western Hall, namely; *Alternaria* sp., *Aspergillus* spp., *Aureobasidium* sp., *Cladosporium* spp., *Curvularia* sp., *Emericella* sp., *Fusarium* spp., *Monilia* sp., *Mucor* sp., *Penicillium* spp., *Rhizopus* sp., *Trichoderma* spp., and Unidentified species. Most of these fungi belong to the subdivision Deuteromycotina or Fungi Imperfecti. The annual distributions of fungi are shown in Appendix C. The dominant airborne fungi in the Hall were *Aspergillus* spp. (69.9%) and *Penicillium* spp. (17.2%). The average annual abundance of airborne fungi in each sampling point is shown in Table 4.2. As the results, it was not found *Emericella* sp. at P1 and *Mucor* sp. at P4. *Monilia* sp. appeared at P2 and P7 while *Rhizopus* sp. did not appear at P2, P3, and P5.

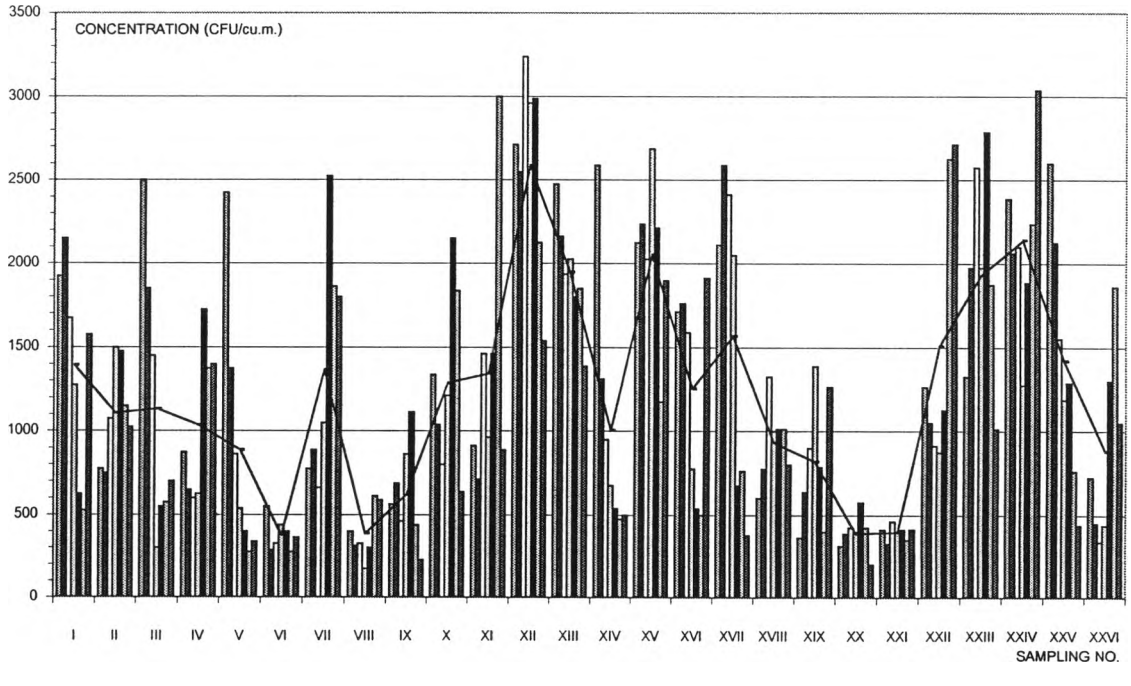

Figure 4.6: Seasonal patterns of total airborne fungi in the Hall.

Table 4.1: The concentration of the total airborne fungi.

	CONCENTRATION OF FUNGI (CFU/CU.M.)							
SAMPLING NO.	P1	P2	P3	P4	P5	P6	P7	AVERAGE
I	1925	2150	1675	1275	625	525	1575	1392.9
II	775	750	1075	1500	1475	1150	1025	1107.1
III	2500	1850	1450	300	550	575	700	1132.1
IV	875	650	600	625	1725	1375	1400	1035.7
V	2425	1375	862.5	537.5	400	275	337.5	887.5
VI	550	287.5	325	437.5	400	275	362.5	376.8
VII	775	887.5	662.5	1050	2525	1862.5	1800	1366.1
VIII	400	312.5	325	175	300	612.5	587.5	387.5
IX	562.5	687.5	462.5	862.5	1112.5	437.5	225	621.4
X	1337.5	1037.5	800	1212.5	2150	1837.5	637.5	1287.5
XI	912.5	712.5	1462.5	962.5	1462.5	**3000**	887.5	1342.9
XII	**2712.5**	2550	**3237.5**	**2962.5**	**2987.5**	2125	1537.5	**2587.5**
XIII	2475	2162.5	1937.5	2025	1800	1850	1387.5	1948.2
XIV	2587.5	1312.5	950	675	537.5	475	500	1005.4
XV	2125	2237.5	2025	2687.5	2212.5	1175	1900	2051.8
XVI	1712.5	1762.5	1587.5	775	537.5	500	1912.5	1255.4
XVII	2112.5	**2587.5**	2412.5	2050	675	762.5	375	1567.9
XVIII	600	775	1325	1000	1012.5	1012.5	800	932.1
XIX	362.5	637.5	900	1387.5	787.5	400	1262.5	819.6
XX	312.5	387.5	425	400	575	425	200	389.3
XXI	412.5	325	462.5	400	412.5	350	412.5	396.4
XXII	1262.5	1050	912.5	875	1125	2625	2712.5	1508.9
XXIII	1325	1975	2575	1975	2787.5	1875	1012.5	1932.1
XXIV	2387.5	2062.5	2100	1275	1887.5	2237.5	**3037.5**	2141.1
XXV	2600	2125	1550	1187.5	1287.5	762.5	437.5	1421.4
XXVI	725	450	337.5	437.5	1300	1862.5	1050	880.4
TOTAL	1413.5	1273.1	1247.6	1117.3	1255.8	1167.8	1079.8	1222.1

Table 4.2: Average abundance of airborne fungi.

	CONCENTRATION OF FUNGI (CFU/CU.M.)								
FUNGAL GENERA	P1	P2	P3	P4	P5	P6	P7	AVERAGE	%
Alternaria sp.	1.9	1.0	0.5	3.8	2.9	2.9	1.4	2.1	0.2
Aspergillus spp.	937.5	807.2	812.5	743.3	951.9	896.2	828.8	853.9	69.9
Aureobasidium sp.	11.5	25.5	17.3	1.0	0.5	4.8	5.8	9.5	0.8
Cladosporium spp.	46.2	47.6	54.8	35.6	22.1	23.1	32.7	37.4	3.1
Curvularia sp.	2.9	1.9	1.4	1.4	2.4	0.5	2.9	1.9	0.2
Emericella sp.	0.0	0.5	0.5	1.9	5.3	1.4	1.9	1.6	0.1
Fusarium spp.	46.2	64.9	35.1	60.6	56.3	52.9	40.4	50.9	4.2
Monilia sp.	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0
Mucor sp.	1.9	3.4	1.4	0.0	1.4	1.9	2.9	1.9	0.2
Penicillium spp.	310.1	261.5	249.0	213.9	167.3	143.3	124.5	210.0	17.2
Rhizopus sp.	0.5	0.0	0.0	0.5	0.0	0.5	4.3	0.8	0.1
Trichoderma spp.	54.8	58.7	72.1	55.3	43.3	39.4	33.2	51.0	4.2
Unidentified species	0.0	0.0	2.9	0.0	2.4	1.0	0.5	1.0	0.1
TOTAL	1413.5	1273.1	1247.6	1117.3	1255.8	1167.8	1079.8	1222.1	100.0

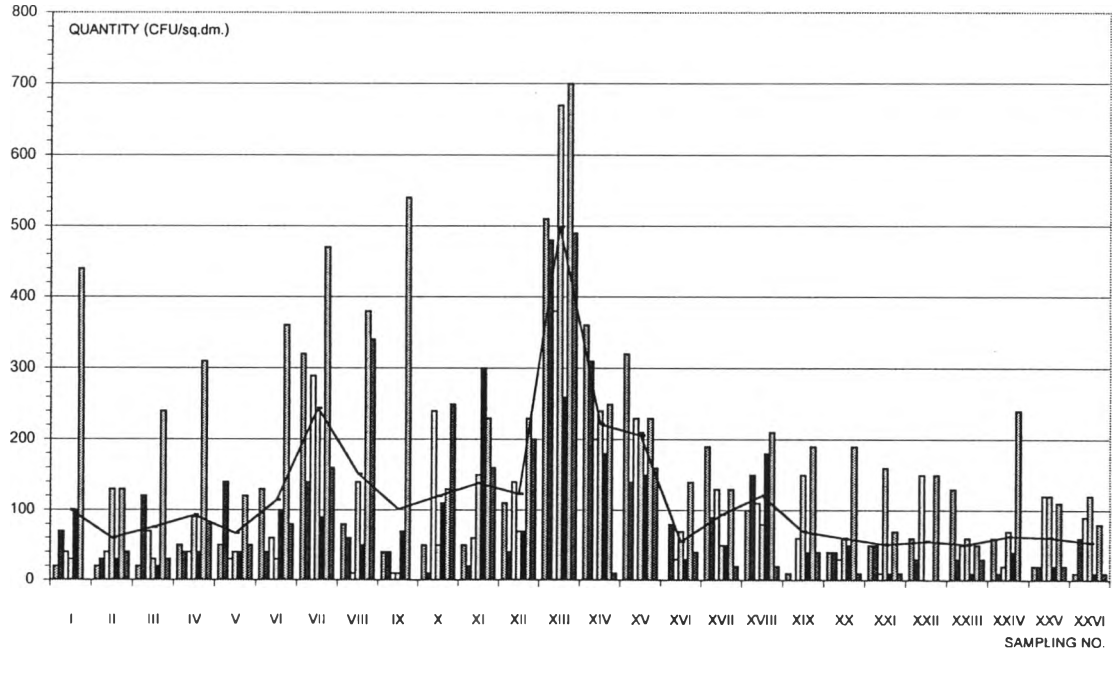

Figure 4.7: Seasonal patterns of total fungi on surface of woodcarving.

Table 4.3: The quantity of total fungi on wood surface.

SAMPLING NO.	QUANTITY OF FUNGI (CFU/SQ.DM.)							
	P1	P2	P3	P4	P5	P6	P7	AVERAGE
I	20	70	40	30	100	440	0	100.0
II	20	30	40	130	30	130	40	60.0
III	20	120	70	30	20	240	30	75.7
IV	50	40	40	90	40	310	80	92.9
V	50	140	30	40	40	120	50	67.1
VI	130	40	60	30	100	360	80	114.3
VII	320	140	290	240	90	470	160	244.3
VIII	80	60	10	140	50	380	340	151.4
IX	40	40	10	10	70	540	0	101.4
X	50	10	240	50	110	130	250	120.0
XI	50	20	60	150	**300**	230	160	138.6
XII	110	40	140	70	70	230	200	122.9
XIII	**510**	**480**	**380**	**670**	260	**700**	**490**	**498.6**
XIV	360	310	200	240	180	250	10	221.4
XV	320	140	230	210	150	230	160	205.7
XVI	0	80	30	70	30	140	40	55.7
XVII	190	90	130	50	50	130	20	94.3
XVIII	100	150	110	80	180	210	20	121.4
XIX	10	0	60	150	40	190	40	70.0
XX	40	40	30	60	50	190	10	60.0
XXI	50	50	10	160	10	70	10	51.4
XXII	60	30	150	0	0	150	0	55.7
XXIII	130	30	50	60	10	50	30	51.4
XXIV	60	10	20	70	40	240	0	62.9
XXV	20	20	120	120	20	110	20	61.4
XXVI	10	60	90	120	10	80	10	54.3
TOTAL	107.7	86.2	101.5	118.1	78.8	243.1	86.5	117.4

The quantity of total fungi on wood surface is shown in Table 4.3 and is graphically presented in Figure 4.7. On the surface of woodcarving, fungi were isolated and identified to be 12 genera. They were *Aspergillus* spp., *Aureobasidium* sp., *Cladosporium* spp., *Curvularia* sp., *Emericella* sp., *Fusarium* spp., *Helminthosporium* sp., *Monilia* sp., *Penicillium* spp., *Rhizopus* sp., *Trichoderma* spp., and Unidentified species. The most abundant of surface fungi in the Hall were *Aspergillus* spp. (51.7%) and *Fusarium* spp. (23.6%). The average annual abundance of surface fungi in each sampling point is shown in Table 4.4.

Table 4.4: Average abundance of surface fungi.

	QUANTITY OF FUNGI (CFU/SQ.DM.)								
FUNGAL GENERA	P1	P2	P3	P4	P5	P6	P7	AVERAGE	%
Aspergillus spp.	72.7	44.6	51.2	60.4	41.2	100.0	54.6	60.7	**51.7**
Aureobasidium sp.	0.0	0.0	0.0	0.0	0.0	0.8	1.5	0.3	0.3
Cladosporium spp.	1.5	4.6	3.1	4.2	3.8	21.2	2.3	5.8	5.0
Curvularia sp.	2.7	1.9	4.6	2.3	3.1	7.7	1.2	3.4	2.9
Emericella sp.	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.1	0.1
Fusarium spp.	16.9	23.8	26.9	39.2	16.9	56.2	13.8	27.7	**23.6**
Helminthosporium sp.	0.0	0.0	0.0	1.5	0.0	0.4	0.0	0.3	0.2
Monilia sp.	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Penicillium spp.	3.8	1.9	3.1	2.7	6.5	13.5	6.2	5.4	4.6
Rhizopus sp.	0.8	0.0	1.2	0.0	0.0	0.0	0.0	0.3	0.2
Trichoderma spp.	6.2	4.2	5.8	4.6	5.4	25.0	5.4	8.1	6.9
Unidentified species	2.7	5.0	5.8	3.1	1.9	17.7	1.5	5.4	4.6
TOTAL	107.7	86.2	101.5	118.1	78.8	243.1	86.5	117.4	100.0

At every sampling point, *Aspergillus* spp. was recorded in highly quantity both in air and on wood surface. *Alternaria* sp. and *Mucor* sp. were found in the air while *Helminthosporium* sp. was found on wood surface.

All fungi were tested for their ability to produce C_X cellulase on solid medium containing Carboxymethyl Cellulose (CMC) and the ratios of the size of the zone where CMC was degraded to colony size were calculated. The averages of those are shown in Table 4.5. Figure 4.8 illustrates the clear zone around the fungal colony.

Table 4.5: Average ratio of the size of CMC hydrolysis zones to colony diameters.

FUNGAL SPECIES	AVERAGE RATIO (RANGE)
Aspergillus flavus	1.18 (1.01-1.69)
Aspergillus fumigatus	1.23 (1.04-2.06)
Aspergillus niger	1.19 (1.04-1.71)
Aspergillus spp.	1.15 (1.02-1.56)
Aureobasidium sp.	1.21 (1.01-1.39)
Cladosporium spp.	1.06 (0.81-1.25)
Curvularia sp.	1.46 (0.97-1.90)
Emericella sp.	1.03 (0.87-1.21)
Fusarium spp.	1.28 (0.81-2.83)
Helminthosporium sp.	1.08 (1.07-1.08)
Monilia sp.	1.01 (1.00-1.02)
Mucor sp.	1.02 (0.92-1.21)
Penicillium spp.	1.25 (1.00-2.28)
Trichoderma spp.	1.33 (0.82-1.82)
Rhizopus sp.	1.02 (1.00-1.07)
Unidentified species	1.08 (0.88-1.50)

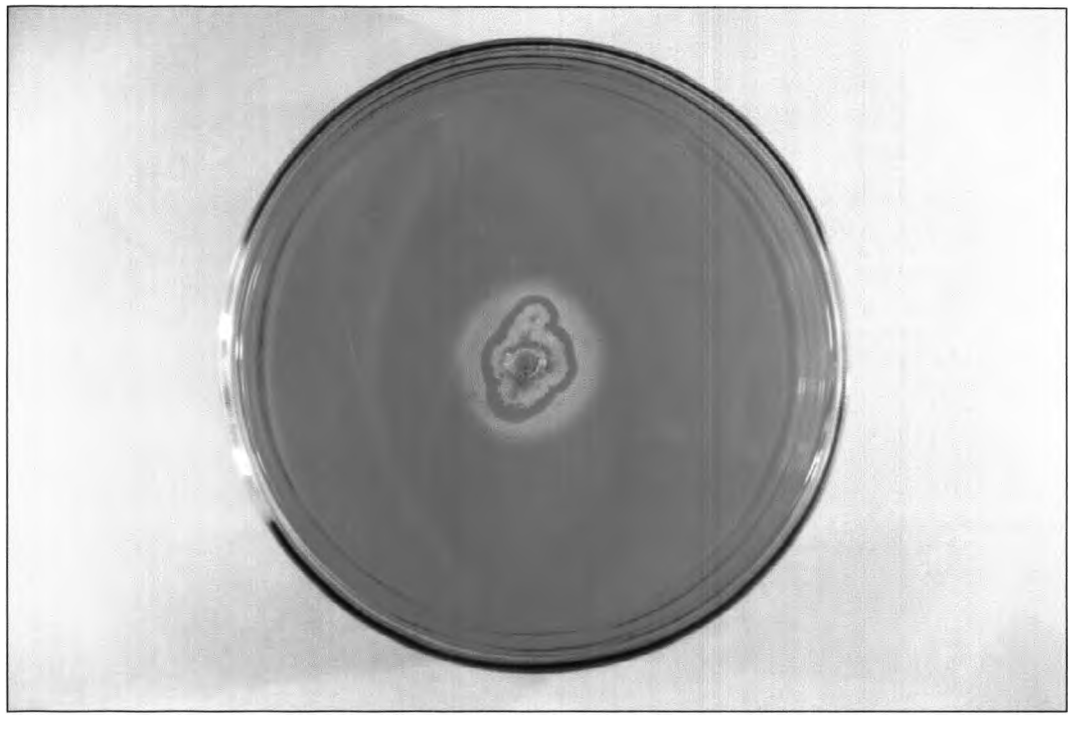

Figure 4.8: The cellulose hydrolysis zone around fungal colony.

Most fungi were able to hydrolyse CMC. Some of them showed distinct clear zones and high activity of cellulolytic enzyme. Cellulase activity was determined by Carboxymethyl Cellulose assay with Congo red staining to confirm the cellulase produce by fungal isolates which might cause the wood deterioration.

Because the most of fungal isolates were cellulolytic fungi, the next results were discussed in total combined fungi.

The quantity of total fungi in each sampling point is shown in Figure 4.9 to Figure 4.15. The concentration of total airborne fungi was peak in rainy season at every point except sampling point no.7 (peak in winter). As the surface of woodcarving, the quantity of total fungi was peak in rainy season at every point.

The seasonal pattern of total combined fungi both in air and on wood were much the same, with a clear peak in July (Figure 4.16).

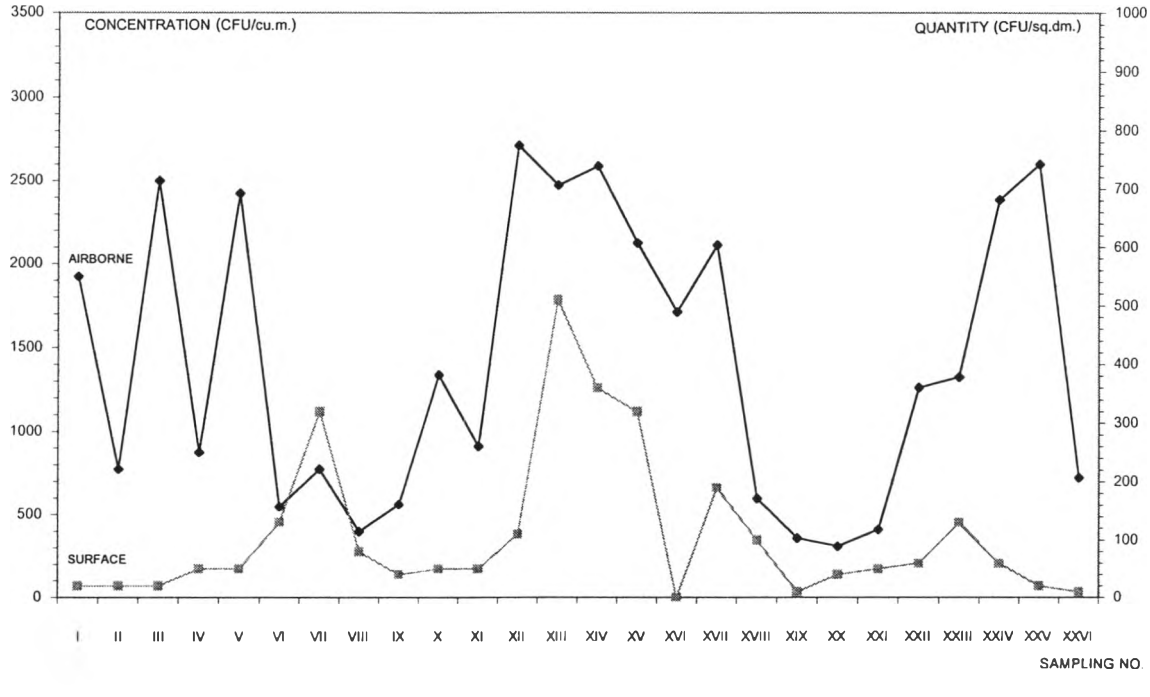

Figure 4.9: Seasonal pattern of total fungi at sampling point no.1.

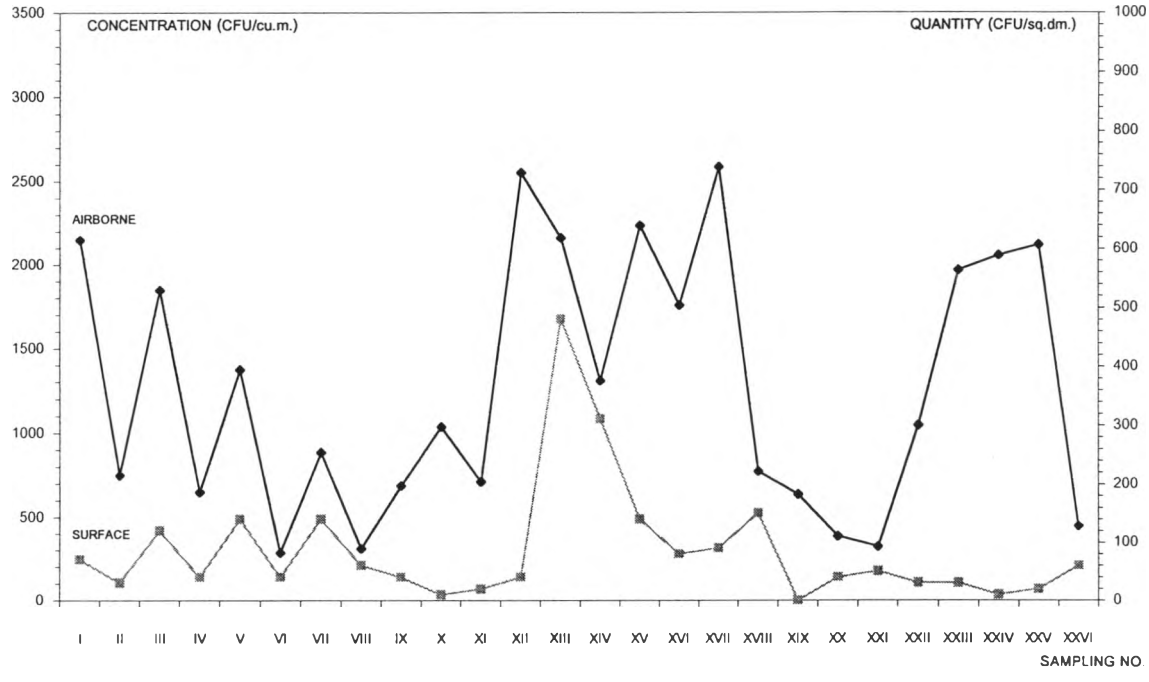

Figure 4.10: Seasonal pattern of total fungi at sampling point no.2.

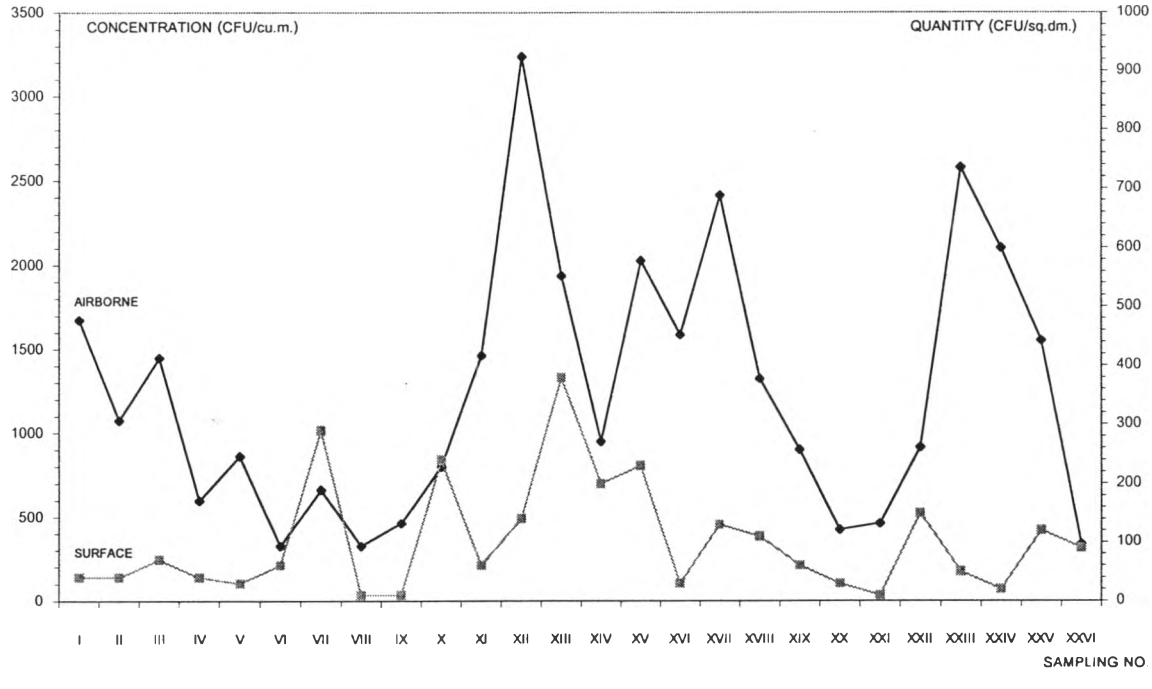

Figure 4.11: Seasonal pattern of total fungi at sampling point no.3.

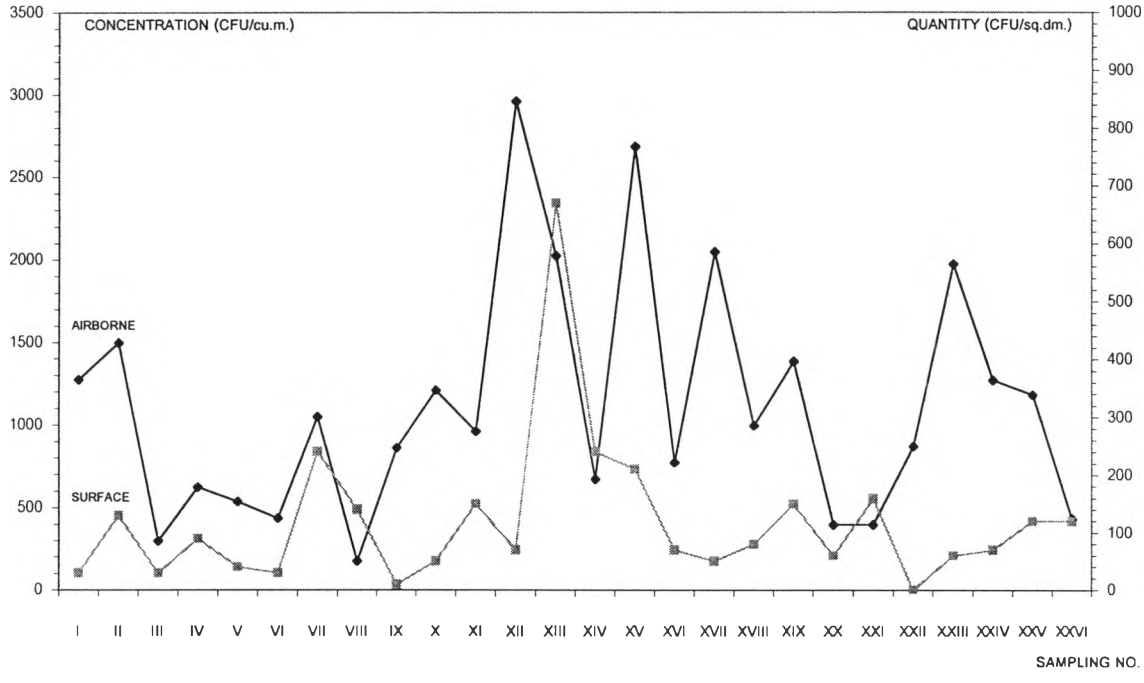

Figure 4.12: Seasonal pattern of total fungi at sampling point no.4.

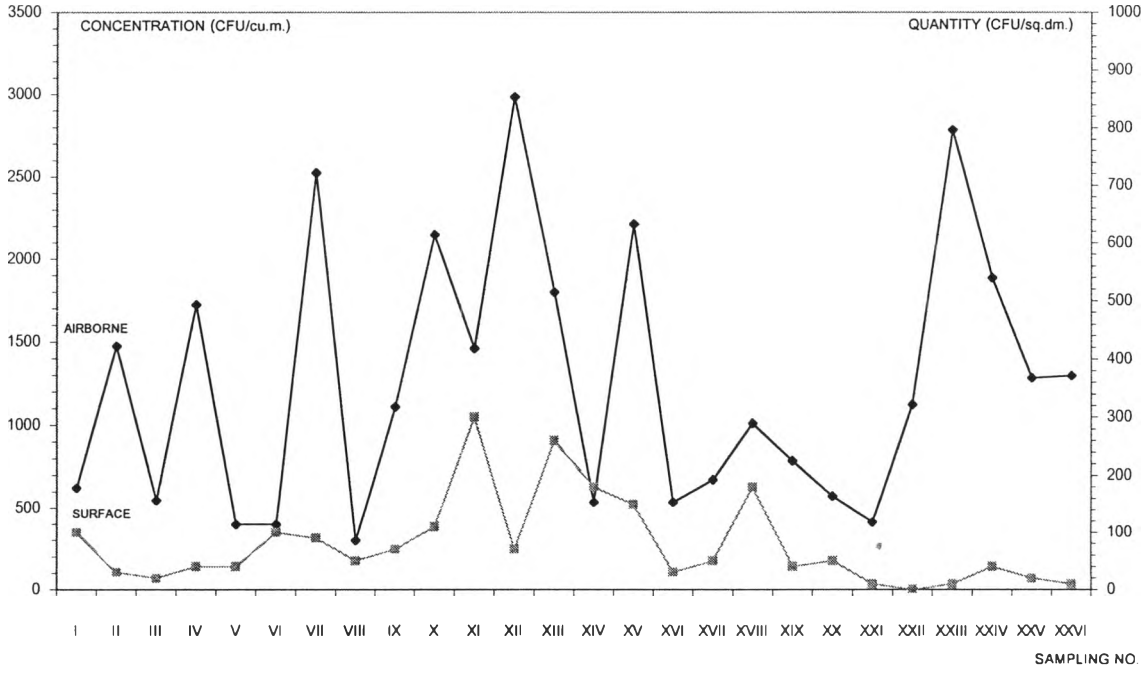

Figure 4.13: Seasonal pattern of total fungi at sampling point no.5.

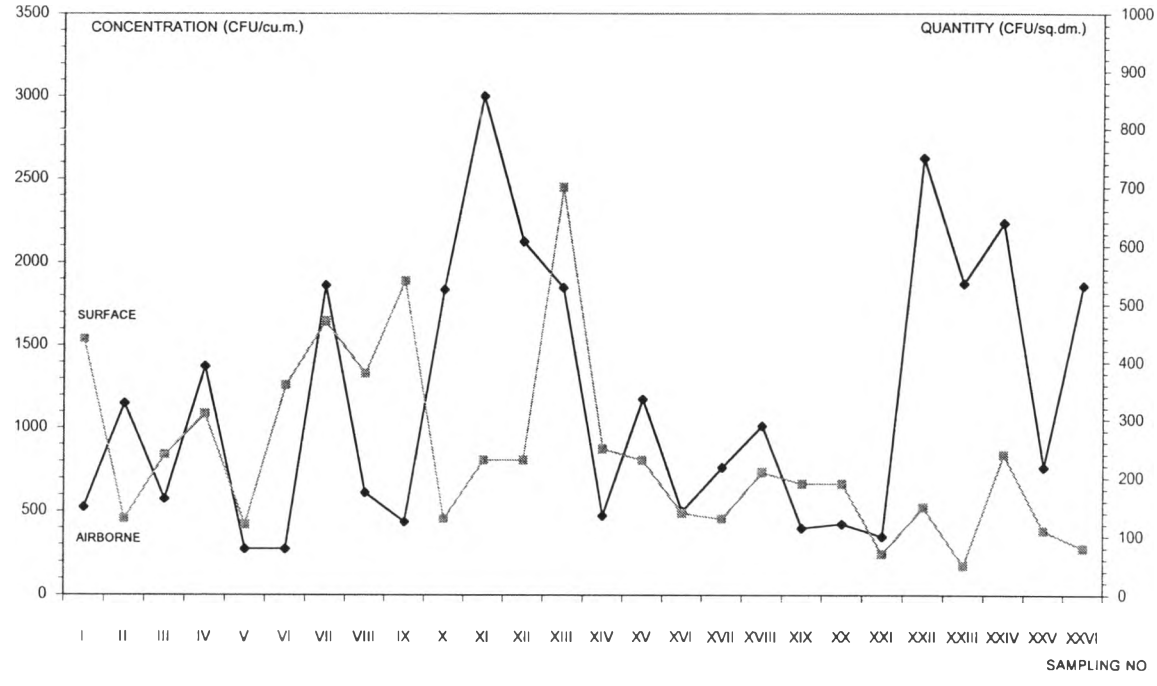

Figure 4.14: Seasonal pattern of total fungi at sampling point no.6.

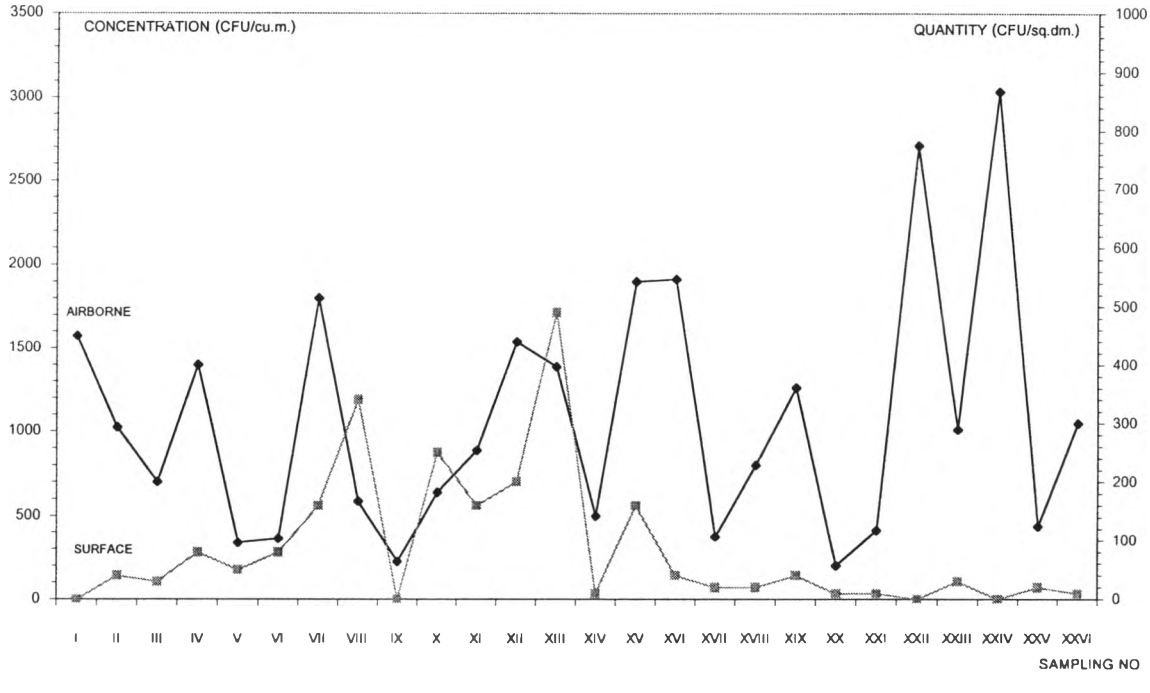

Figure 4.15: Seasonal pattern of total fungi at sampling point no.7.

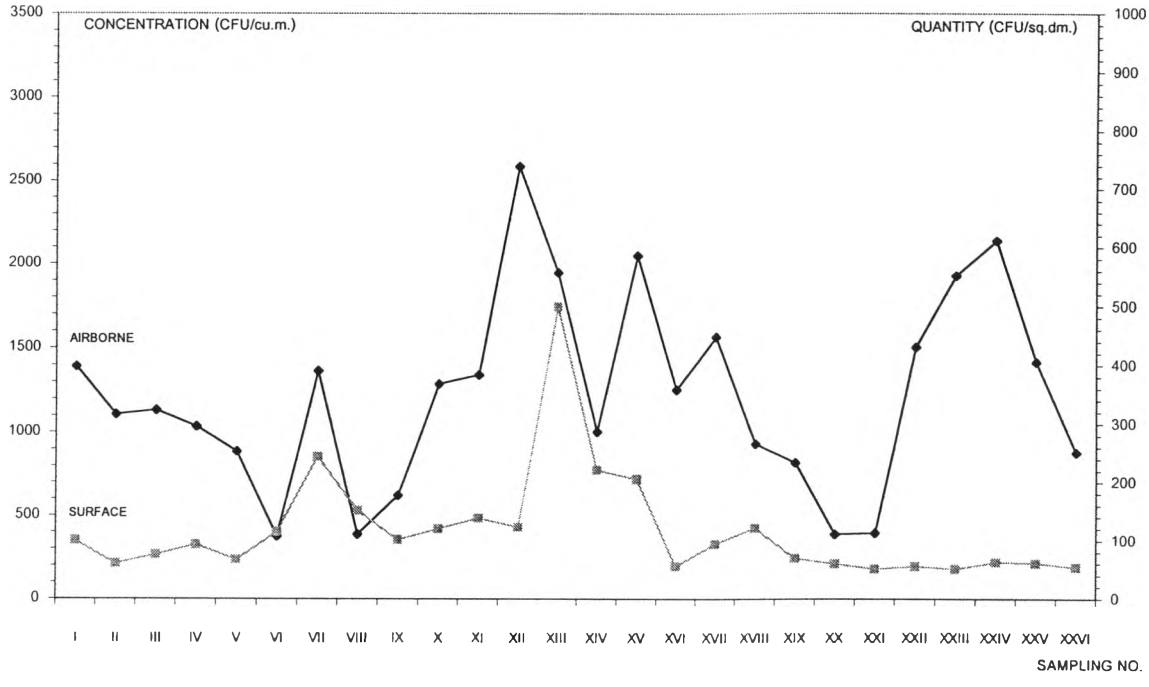

Figure 4.16: The seasonal pattern of average total fungi both in air and on wood.

Table 4.6: Correlation coefficients of airborne fungi between each sampling point.

	P 1	P 2	P 3	P 4	P 5	P 6	P7
P 1	1						
P 2	0.8749	1					
P 3	0.6785	0.8890	1				
P 4	0.4490	0.7072	0.8259	1			
P 5	0.1952	0.3577	0.5193	0.6892	1		
P 6	0.0932	0.1497	0.3439	0.3589	0.7090	1	
P 7	0.2266	0.3292	0.3530	0.3310	0.4316	0.5680	1

Table 4.7: Correlation coefficients of surface fungi between each sampling point.

	P 1	P 2	P 3	P 4	P 5	P 6	P7
P 1	1						
P 2	0.8329	1					
P 3	0.8123	0.6682	1				
P 4	0.7825	0.8072	0.6862	1			
P 5	0.5724	0.5608	0.5041	0.5680	1		
P 6	0.5172	0.5261	0.3693	0.5208	0.4836	1	
P 7	0.5477	0.4861	0.5891	0.6894	0.5157	0.5370	1

The correlation of fungal abundance in each point was studied (Table 4.6 and Table 4.7). It was found that positive correlation between concentration of airborne fungi and distance of sampling point. There is strong correlation between near point. The correlation decreased in long distance of each point. Otherwise, there is no correlation in fungi on surface of woodcarving.

In addition, the community similarity of fungal type and quantity were studied by calculating with Morisita's similarity index. The similarity index of airborne fungi and surface fungi are presented in Table 4.8 and 4.9. There were found that highly similarity index between each point both in airborne fungi and surface fungi. This finding is probably due to the similarity of fungal type and quantity between each sampling point in the Western Hall.

Table 4.8: Morisita's similarity index of airborne fungi.

	P1	P2	P3	P4	P5	P6	P7
P1	1.00000						
P2	0.99774	1.00000					
P3	0.99878	0.99999	1.00000				
P4	0.99786	0.99883	0.99957	1.00000			
P5	0.98432	0.98034	0.98488	0.98919	1.00000		
P6	0.98187	0.97770	0.98260	0.98719	1.00161	1.00000	
P7	0.97913	0.97484	0.98025	0.98440	0.99978	1.00081	1.00000

Table 4.9: Morisita's similarity index of surface fungi.

	P1	P2	P3	P4	P5	P6	P7
P1	1.00000						
P2	0.95096	1.00000					
P3	0.94921	0.99754	1.00000				
P4	0.93364	0.99402	0.99129	1.00000			
P5	0.96402	0.98630	0.98937	0.97396	1.00000		
P6	0.88573	0.96877	0.97268	0.95241	0.96906	1.00000	
P7	0.99628	0.95900	0.95806	0.94149	0.97800	0.90840	1.00000

Fluctuations in quantity of fungi are illustrated in Figure 4.17 to Figure 4.19. The average concentration of total airborne fungi in summer was around 923.0 CFU/m^3, in rainy season was around 1,630.8 CFU/m^3, and in winter was around 1,157.9 CFU/m^3.

On surface of woodcarving, the average quantity of total fungi in summer was around 111.9 CFU/dm^2, in rainy season was around 182.1 CFU/dm^2, and in winter was around 65.4 CFU/dm^2.

The average quantities of fungi both in air and on wood were likely to differ between seasons. The data were tested in statistical difference by t-test foe mean at 95% confidence (Appendix D).

For airborne fungi, there was found that this difference between rainy season and summer was significant ($p<0.05$).

For surface fungi, there was no statistically significant difference between rainy season and summer.

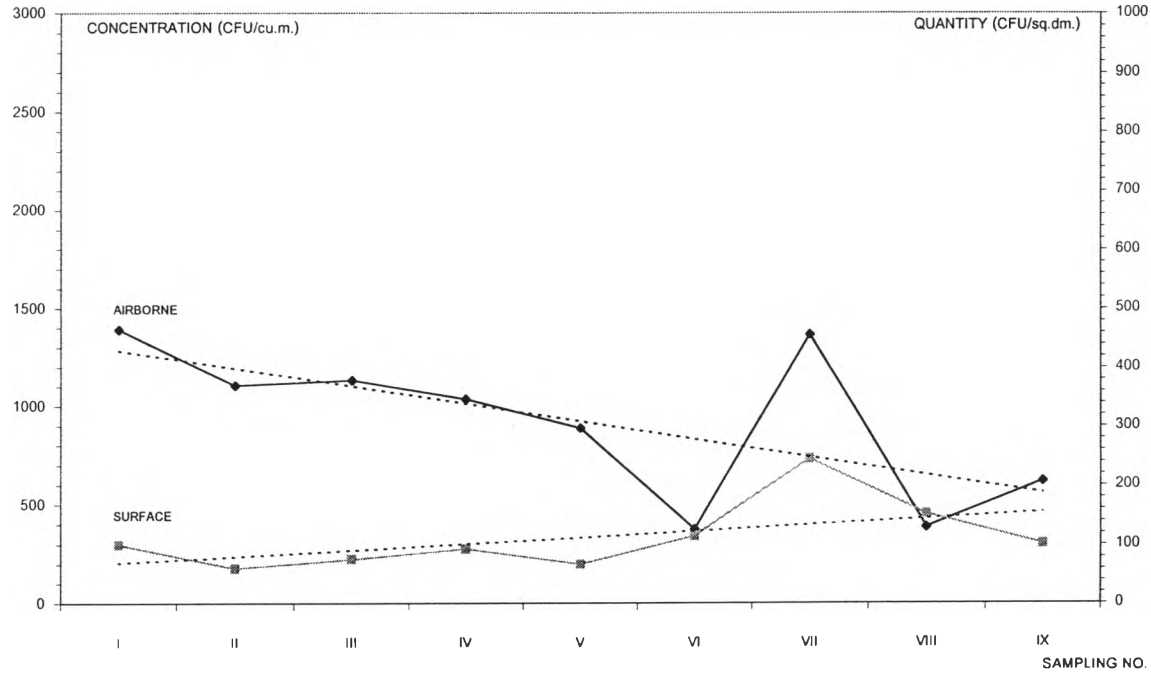

Figure 4.17: Average total fungi in summer season.

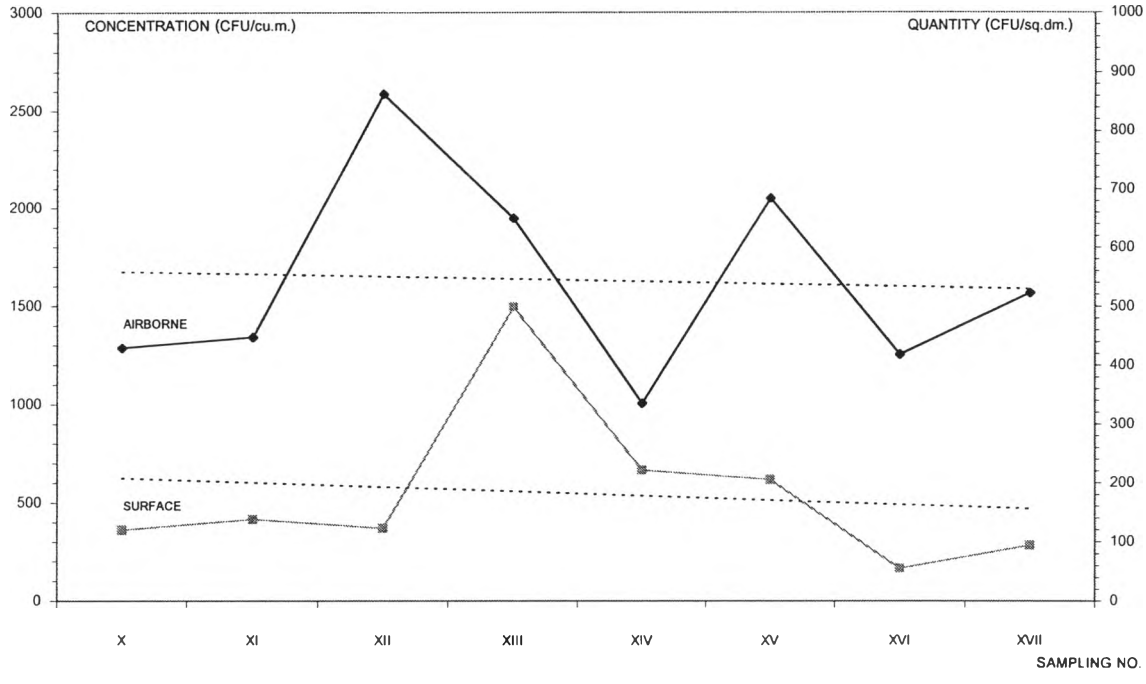

Figure 4.18: Average total fungi in rainy season.

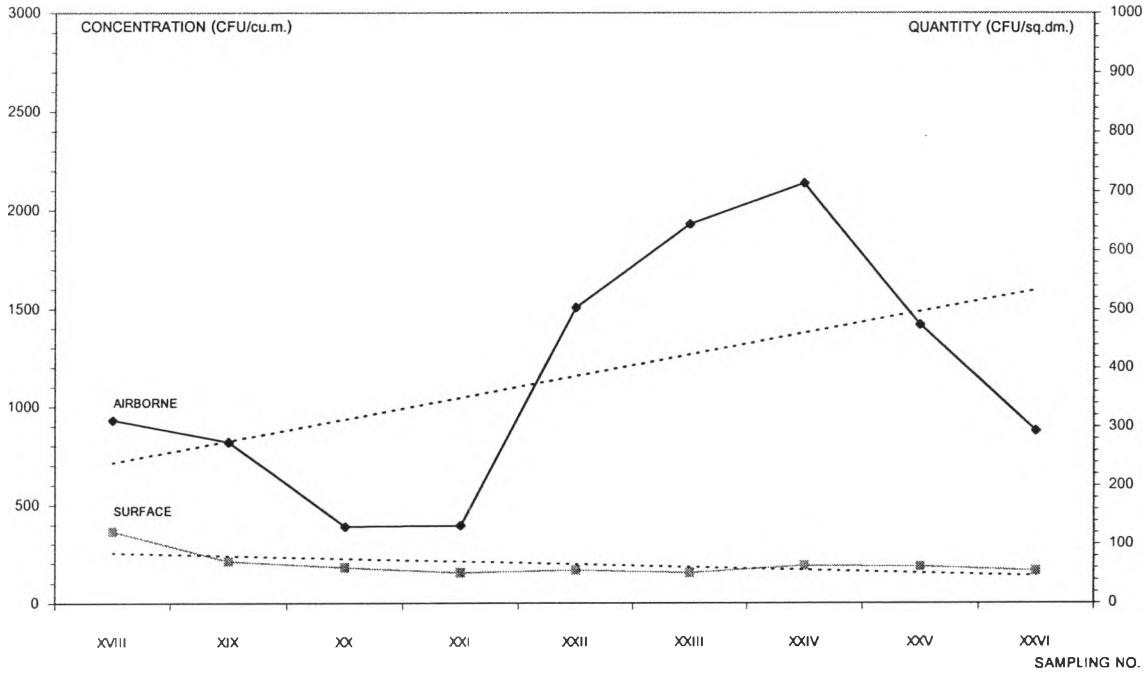

Figure 4.19: Average total fungi in winter season.

Table 4.10: Correlation coefficient between airborne fungi and surface fungi.

SAMPLING POINT	CORRELATION COEFFICIENT
P1	0.3316
P2	0.2662
P3	0.2208
P4	0.2612
P5	0.1351
P6	-0.0118
P7	0.0363
AVERAGE	0.2726

The correlation between airborne fungi and surface fungi was studied (Table 4.10). It was weakly correlated between airborne fungi and surface fungi in each point.

The pool data of fungi were calculated for Simpson's diversity index and Simpson's dominance index. Table 4.11 to 4.14 present these index throughout the year. The airborne fungi at southern sampling points (P5, P6, and P7) were shown low diversity index while dominance index were high. The diversity index of surface fungi at P6 was high but the dominance index was low.

The seasonal diversity index and dominance index were calculated (Table 4.15 and 4.16). The dominance index was high in rainy season both in airborne fungi and surface fungi. The diversity index of airborne fungi was high in summer while that of surface fungi was high in winter. The results of fungal quantity and the diversity index are illustrated in Figure 4.20 to 4.33.

From the data obtained, it was found the negative relationship between the quantity of fungi and the diversity index. This phenomenon needs to be more understand in the study of fungal ecology.

The difference of fungal abundance between the well-ventilated area (P3) and poor-ventilated area (P4) was investigated (Appendix E). There was no statistically difference due to possibly non-replica seasonal sampling in this study. In addition, the *El ninõ* phenomenon might affect the climatic condition during the year. When the environment changed, it could be impact on the fungal ecology in this Hall.

Table 4.11: Simpson's diversity index of airborne fungi.

SAMPLING	DIVERSITY INDEX						
NO.	P1	P2	P3	P4	P5	P6	P7
I	2.12	1.98	1.91	2.30	1.97	2.34	2.27
II	2.17	3.34	4.21	1.34	1.61	1.14	2.65
III	2.67	3.21	2.78	3.46	1.81	5.38	4.64
IV	2.76	3.17	3.76	2.60	1.62	1.99	2.55
V	1.04	1.57	1.93	2.30	2.39	2.59	3.55
VI	1.85	2.57	2.91	1.94	2.10	3.49	3.08
VII	2.08	2.16	2.27	1.22	1.03	1.00	1.00
VIII	1.64	1.17	1.64	1.56	1.73	1.22	1.19
IX	2.03	1.62	1.78	1.26	1.20	1.12	1.00
X	1.52	1.54	1.96	1.25	1.10	1.04	1.42
XI	1.56	1.38	1.19	1.17	1.43	1.00	1.32
XII	1.00	1.08	1.00	1.00	1.00	1.19	1.22
XIII	1.30	1.68	2.02	2.46	1.47	1.37	1.40
XIV	2.01	2.23	2.93	2.38	2.85	1.55	2.86
XV	1.67	1.27	1.41	1.09	1.03	1.35	1.24
XVI	1.52	1.53	1.34	1.54	3.22	1.89	1.14
XVII	2.02	2.30	1.83	1.58	2.32	1.93	2.01
XVIII	2.98	2.75	1.43	1.95	2.03	2.51	3.25
XIX	3.01	4.34	2.83	3.28	4.64	2.68	1.34
XX	3.48	2.44	4.22	3.43	3.19	4.59	2.87
XXI	5.21	2.76	3.77	4.65	3.43	3.32	3.82
XXII	1.85	1.94	1.76	1.68	1.45	1.08	1.01
XXIII	2.79	1.30	1.11	1.45	1.00	1.48	1.76
XXIV	1.11	1.46	1.36	1.63	1.29	1.36	1.10
XXV	1.03	1.12	1.39	1.45	1.78	1.30	1.80
XXVI	1.98	1.99	2.00	2.68	1.60	1.07	1.13
	2.03	2.22	2.13	2.06	1.68	1.65	1.65

Table 4.12: Simpson's diversity index of surface fungi.

SAMPLING NO.	DIVERSITY INDEX						
	P1	P2	P3	P4	P5	P6	P7
I	1.00	1.99	2.05	1.85	1.00	2.55	0.00
II	2.11	1.85	2.79	2.34	1.00	2.72	2.79
III	1.00	2.61	1.71	1.85	1.00	4.80	1.00
IV	1.96	2.79	4.33	1.00	1.00	2.60	1.61
V	3.77	1.00	1.85	2.79	1.00	3.19	1.00
VI	1.56	1.00	1.82	1.00	1.48	2.06	2.72
VII	1.06	1.33	1.31	1.00	1.82	1.67	1.00
VIII	2.72	1.82	1.00	1.00	1.96	2.41	1.54
IX	2.05	2.79	1.00	1.00	3.93	4.11	0.00
X	3.77	1.00	2.57	2.88	2.50	1.87	1.18
XI	1.48	1.00	4.78	3.89	2.20	3.40	3.61
XII	1.46	2.79	1.56	1.99	2.38	3.91	2.37
XIII	1.97	2.04	1.98	2.06	1.17	1.55	1.79
XIV	1.18	1.14	1.22	2.34	1.12	2.75	1.00
XV	1.00	1.15	1.31	1.64	1.52	1.96	1.98
XVI	0.00	1.00	3.22	1.00	1.00	2.68	2.05
XVII	1.00	2.00	1.17	2.33	1.00	1.75	1.00
XVIII	1.00	1.14	1.20	1.00	2.44	1.48	1.00
XIX	1.00	0.00	1.82	2.55	1.00	2.12	1.00
XX	1.62	1.62	1.00	1.39	2.88	1.23	1.00
XXI	2.88	2.88	1.00	2.19	1.00	1.71	1.00
XXII	3.77	1.85	1.48	0.00	0.00	3.63	0.00
XXIII	1.91	1.85	1.48	1.39	1.00	1.48	1.00
XXIV	1.00	1.00	1.00	3.93	1.00	2.13	0.00
XXV	2.11	2.11	1.18	2.07	1.00	2.50	1.00
XXVI	1.00	1.82	2.00	2.02	1.00	2.72	1.00
	2.06	2.82	2.99	2.66	2.99	4.00	2.30

Table 4.13: Simpson's dominance index of airborne fungi.

SAMPLING	DOMINANCE INDEX						
NO.	P1	P2	P3	P4	P5	P6	P7
I	0.47170	0.50505	0.52356	0.43478	0.50761	0.42735	0.44053
II	0.46083	0.29940	0.23753	0.74627	0.62112	0.87719	0.37736
III	0.37453	0.31153	0.35971	0.28902	0.55249	0.18587	0.21552
IV	0.36232	0.31546	0.26596	0.38462	0.61728	0.50251	0.39216
V	0.96154	0.63694	0.51813	0.43478	0.41841	0.38610	0.28169
VI	0.54054	0.38911	0.34364	0.51546	0.47619	0.28653	0.32468
VII	0.48077	0.46296	0.44053	0.81967	0.97087	1.00000	1.00000
VIII	0.60976	0.85470	0.60976	0.64103	0.57803	0.81967	0.84034
IX	0.49261	0.61728	0.56180	0.79365	0.83333	0.89286	1.00000
X	0.65789	0.64935	0.51020	0.80000	0.90909	0.96154	0.70423
XI	0.64103	0.72464	0.84034	0.85470	0.69930	1.00000	0.75758
XII	1.00000	0.92593	1.00000	1.00000	1.00000	0.84034	0.81967
XIII	0.76923	0.59524	0.49505	0.40650	0.68027	0.72993	0.71429
XIV	0.49751	0.44843	0.34130	0.42017	0.35088	0.64516	0.34965
XV	0.59880	0.78740	0.70922	0.91743	0.97087	0.74074	0.80645
XVI	0.65789	0.65359	0.74627	0.64935	0.31056	0.52910	0.87719
XVII	0.49505	0.43478	0.54645	0.63291	0.43103	0.51813	0.49751
XVIII	0.33557	0.36364	0.69930	0.51282	0.49261	0.39841	0.30769
XIX	0.33223	0.23041	0.35336	0.30488	0.21552	0.37313	0.74627
XX	0.28736	0.40984	0.23697	0.29155	0.31348	0.21786	0.34843
XXI	0.19194	0.36232	0.26525	0.21505	0.29155	0.30120	0.26178
XXII	0.54054	0.51546	0.56818	0.59524	0.68966	0.92593	0.99010
XXIII	0.35842	0.76923	0.90090	0.68966	1.00000	0.67568	0.56818
XXIV	0.90090	0.68493	0.73529	0.61350	0.77519	0.73529	0.90909
XXV	0.97087	0.89286	0.71942	0.68966	0.56180	0.76923	0.55556
XXVI	0.50505	0.50251	0.50000	0.37313	0.62500	0.93458	0.88496
	0.49261	0.45045	0.46948	0.48544	0.59524	0.60606	0.60606

Table 4.14: Simpson's dominance index of surface fungi.

SAMPLING	DOMINANCE INDEX						
NO.	P1	P2	P3	P4	P5	P6	P7
I	1.00000	0.50251	0.48780	0.54054	1.00000	0.39216	0.00000
II	0.47393	0.54054	0.35842	0.42735	1.00000	0.36765	0.35842
III	1.00000	0.38314	0.58480	0.54054	1.00000	0.20833	1.00000
IV	0.51020	0.35842	0.23095	1.00000	1.00000	0.38462	0.62112
V	0.26525	1.00000	0.54054	0.35842	1.00000	0.31348	1.00000
VI	0.64103	1.00000	0.54945	1.00000	0.67568	0.48544	0.36765
VII	0.94340	0.75188	0.76336	1.00000	0.54945	0.59880	1.00000
VIII	0.36765	0.54945	1.00000	1.00000	0.51020	0.41494	0.64935
IX	0.48780	0.35842	1.00000	1.00000	0.25445	0.24331	0.00000
X	0.26525	1.00000	0.38911	0.34722	0.40000	0.53476	0.84746
XI	0.67568	1.00000	0.20921	0.25707	0.45455	0.29412	0.27701
XII	0.68493	0.35842	0.64103	0.50251	0.42017	0.25575	0.42194
XIII	0.50761	0.49020	0.50505	0.48544	0.85470	0.64516	0.55866
XIV	0.84746	0.87719	0.81967	0.42735	0.89286	0.36364	1.00000
XV	1.00000	0.86957	0.76336	0.60976	0.65789	0.51020	0.50505
XVI	0.00000	1.00000	0.31056	1.00000	1.00000	0.37313	0.48780
XVII	1.00000	0.50000	0.85470	0.42918	1.00000	0.57143	1.00000
XVIII	1.00000	0.87719	0.83333	1.00000	0.40984	0.67568	1.00000
XIX	1.00000	0.00000	0.54945	0.39216	1.00000	0.47170	1.00000
XX	0.61728	0.61728	1.00000	0.71942	0.34722	0.81301	1.00000
XXI	0.34722	0.34722	1.00000	0.45662	1.00000	0.58480	1.00000
XXII	0.26525	0.54054	0.67568	0.00000	0.00000	0.27548	0.00000
XXIII	0.52356	0.54054	0.67568	0.71942	1.00000	0.67568	1.00000
XXIV	1.00000	1.00000	1.00000	0.25445	1.00000	0.46948	0.00000
XXV	0.47393	0.47393	0.84746	0.48309	1.00000	0.40000	1.00000
XXVI	1.00000	0.54945	0.50000	0.49505	1.00000	0.36765	1.00000
	0.48544	0.35461	0.33445	0.37594	0.33445	0.25000	0.43478

Table 4.15: The seasonal diversity index and dominance index of airborne fungi.

	DIVERSITY INDEX				DOMINANCE INDEX			
	SUMMER	RAINY SEASON	WINTER	ANNUAL	SUMMER	RAINY SEASON	WINTER	ANNUAL
P1	2.69	1.64	2.04	2.03	0.37	0.61	1.49	0.49
P2	3.69	1.71	1.93	2.22	0.27	0.59	0.52	0.45
P3	3.72	1.58	1.98	2.13	0.27	0.63	0.51	0.47
P4	2.76	1.40	2.61	2.06	0.36	0.71	0.38	0.49
P5	1.92	1.33	1.94	1.68	0.52	0.75	0.52	0.60
P6	2.32	1.32	1.68	1.65	0.43	0.76	0.60	0.61
P7	2.40	1.38	1.45	1.65	0.42	0.73	0.69	0.61

Table 4.16: The seasonal diversity index and dominance index of surface fungi.

	DIVERSITY INDEX				DOMINANCE INDEX			
	SUMMER	RAINY SEASON	WINTER	ANNUAL	SUMMER	RAINY SEASON	WINTER	ANNUAL
P1	2.63	1.50	3.73	2.06	0.38	0.67	0.27	0.49
P2	2.62	2.17	3.39	2.82	0.38	0.46	0.29	0.35
P3	3.33	2.10	2.99	2.99	0.30	0.48	0.33	0.33
P4	2.19	2.47	2.91	2.66	0.46	0.40	0.34	0.38
P5	4.66	1.85	3.38	2.99	0.21	0.54	0.30	0.33
P6	4.31	2.47	5.17	4.00	0.23	0.40	0.19	0.25
P7	1.77	2.44	3.21	2.30	0.57	0.41	0.31	0.43

Furthermore, the effect of temperature and relative humidity on fungi was compared between P3 and P4 (Appendix F). In airborne fungi, there was found that the temperature and/or RH were not affecting on fungal concentration. In surface fungi, the effect of temperature and/or RH on fungal quantity was not occurred at P4. However, the temperature affected on fungal quantity at P3 ($p<0.05$) and the interaction between temperature and RH was effect too.

On the basis these results it might be concluded that the primary cause appears to be the adverse conditions of moisture and temperature, which accelerated the quantity of fungi in the Western Hall.

It seems likely that in rainy season when atmospheric humidity is near saturation, fungal growth is initiated. In fact RH above 70% is enough to promote the germination and growth of fungal species. The fungal hyphae grow and enter underside of wood and cause deterioration of wood. It was also observed that in some cases microbial growth could be found on birds and bats excreta.

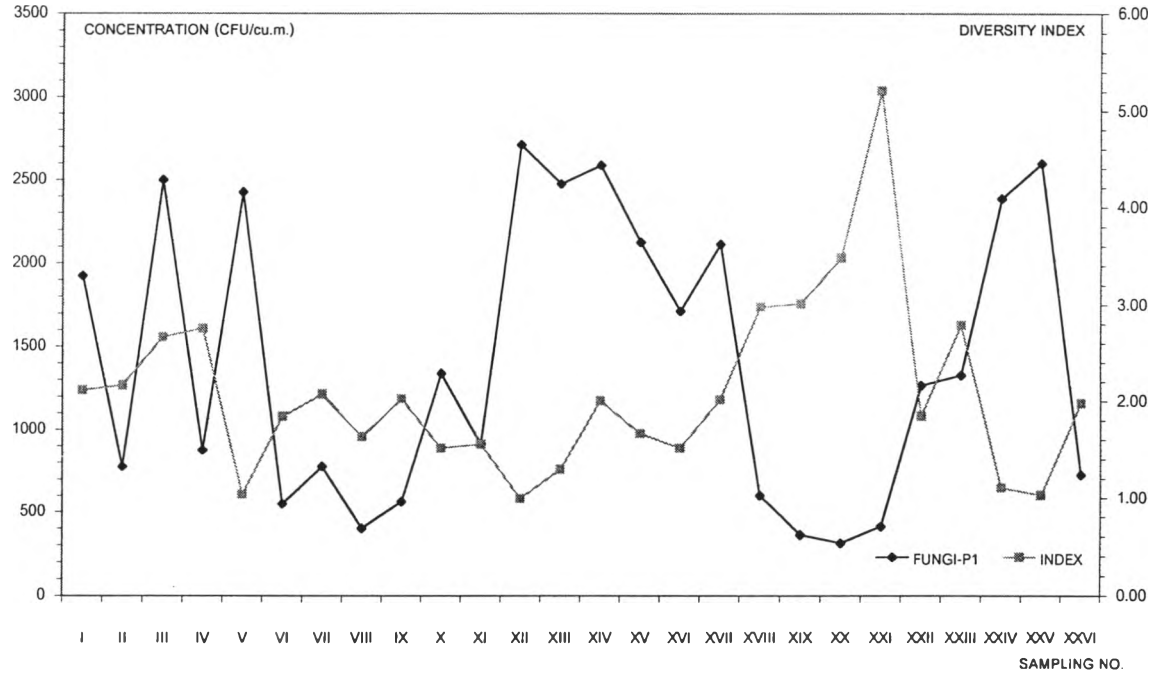

Figure 4.20: Seasonal pattern of total airborne fungi and Simpson's diversity index at P1.

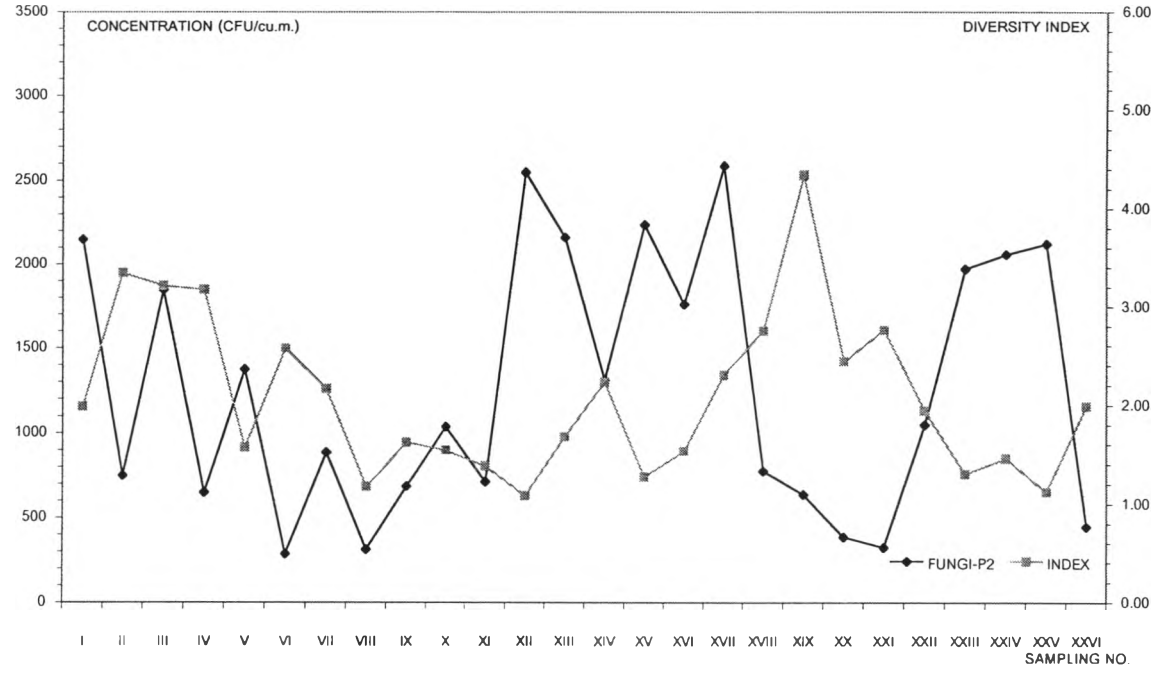

Figure 4.21: Seasonal pattern of total airborne fungi and Simpson's diversity index at P2.

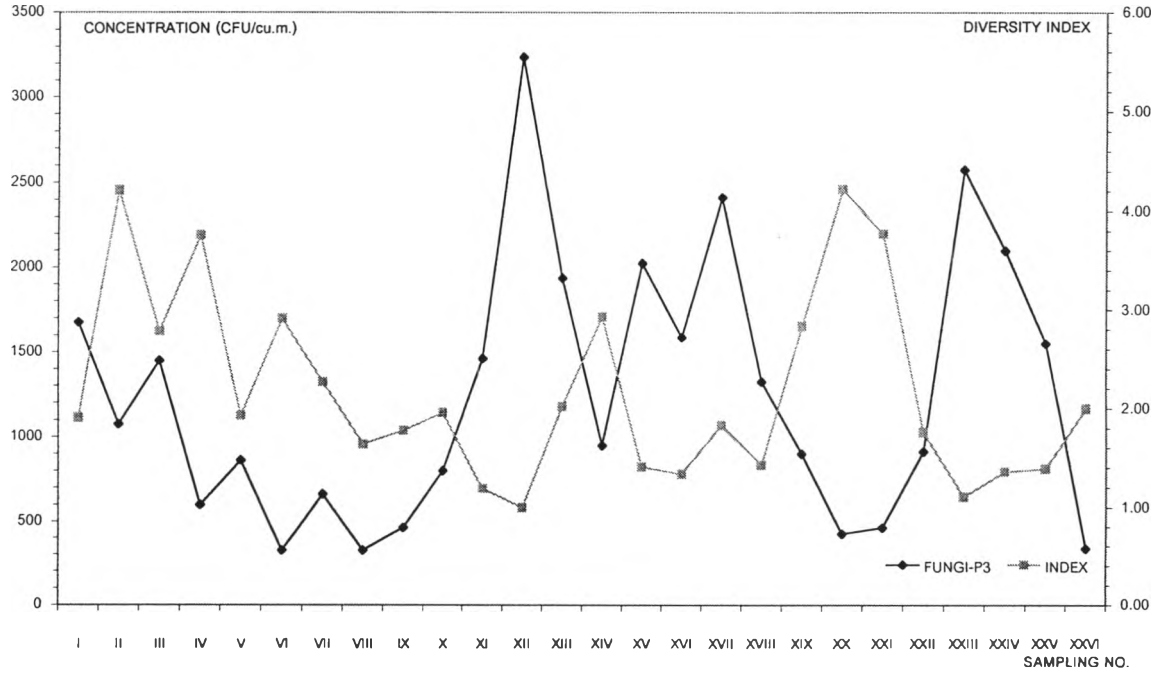

Figure 4.22: Seasonal pattern of total airborne fungi and Simpson's diversity index at P3.

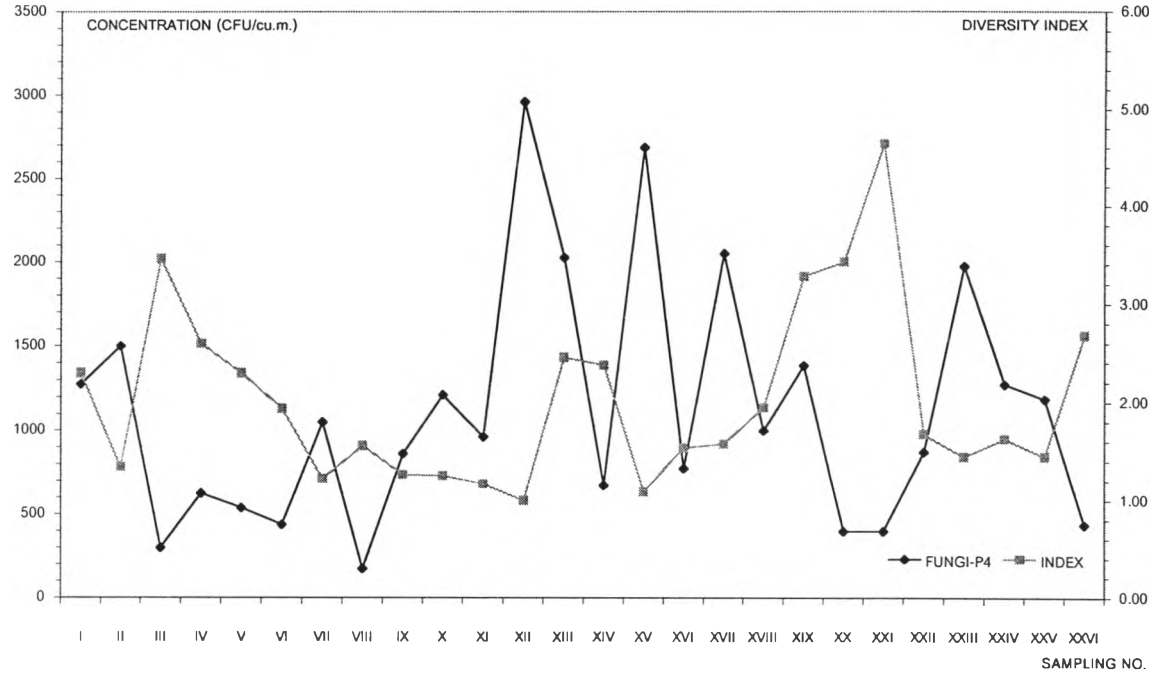

Figure 4.23: Seasonal pattern of total airborne fungi and Simpson's diversity index at P4.

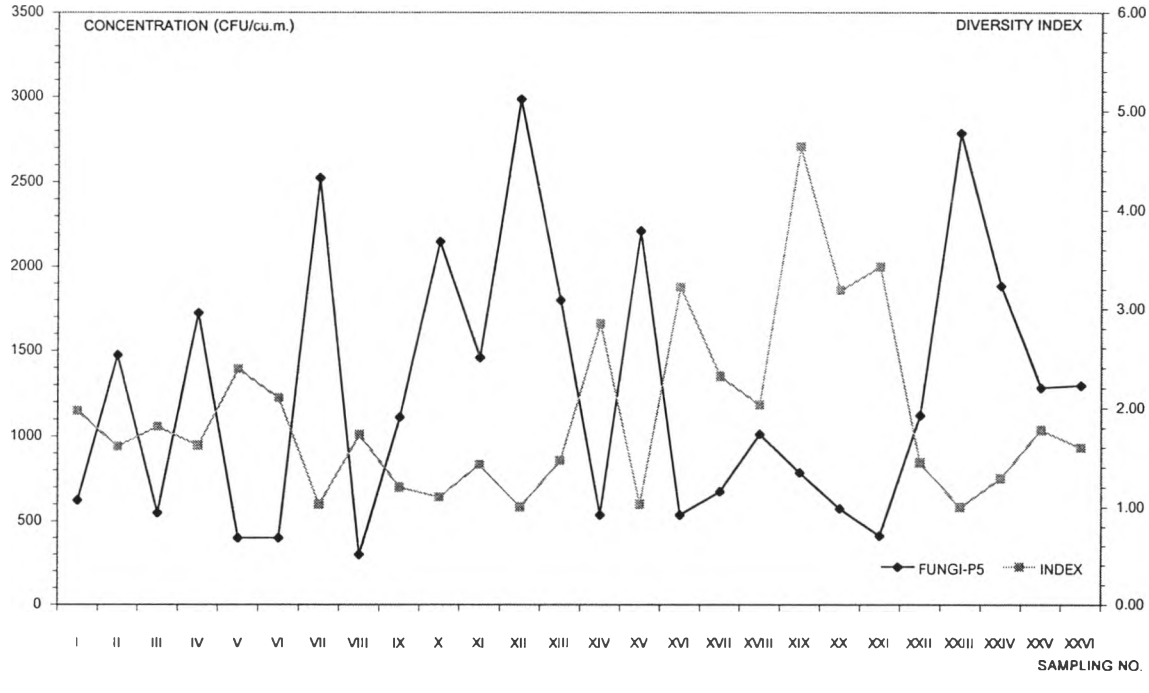

Figure 4.24: Seasonal pattern of total airborne fungi and Simpson's diversity index at P5.

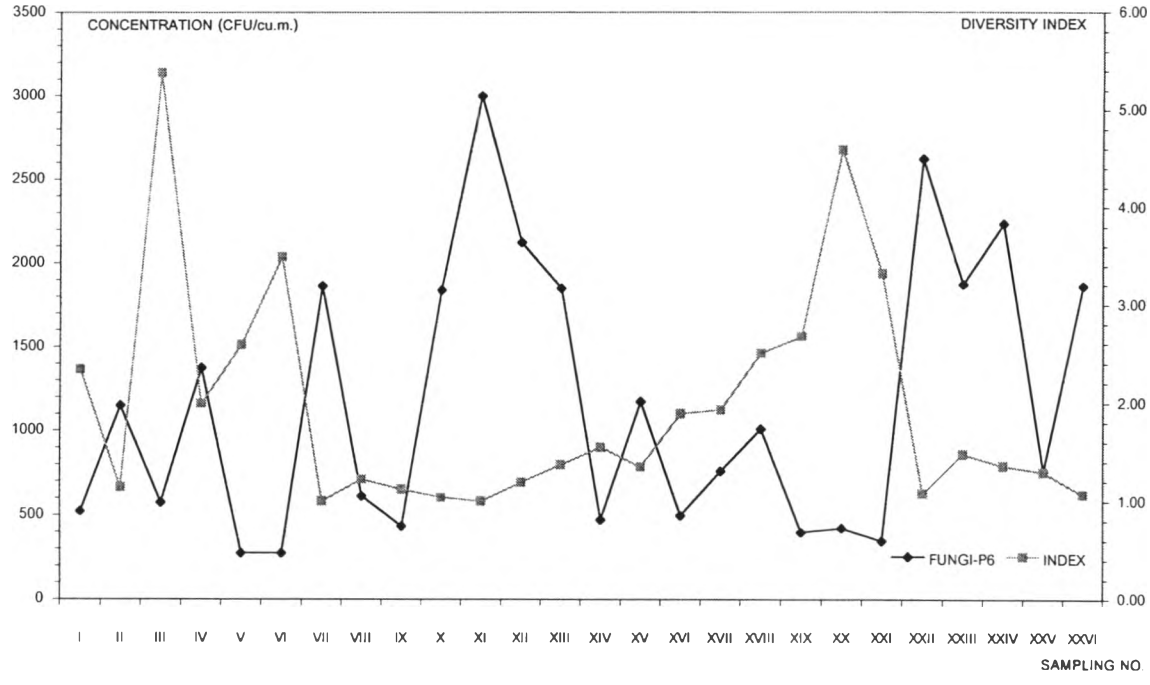

Figure 4.25: Seasonal pattern of total airborne fungi and Simpson's diversity index at P6.

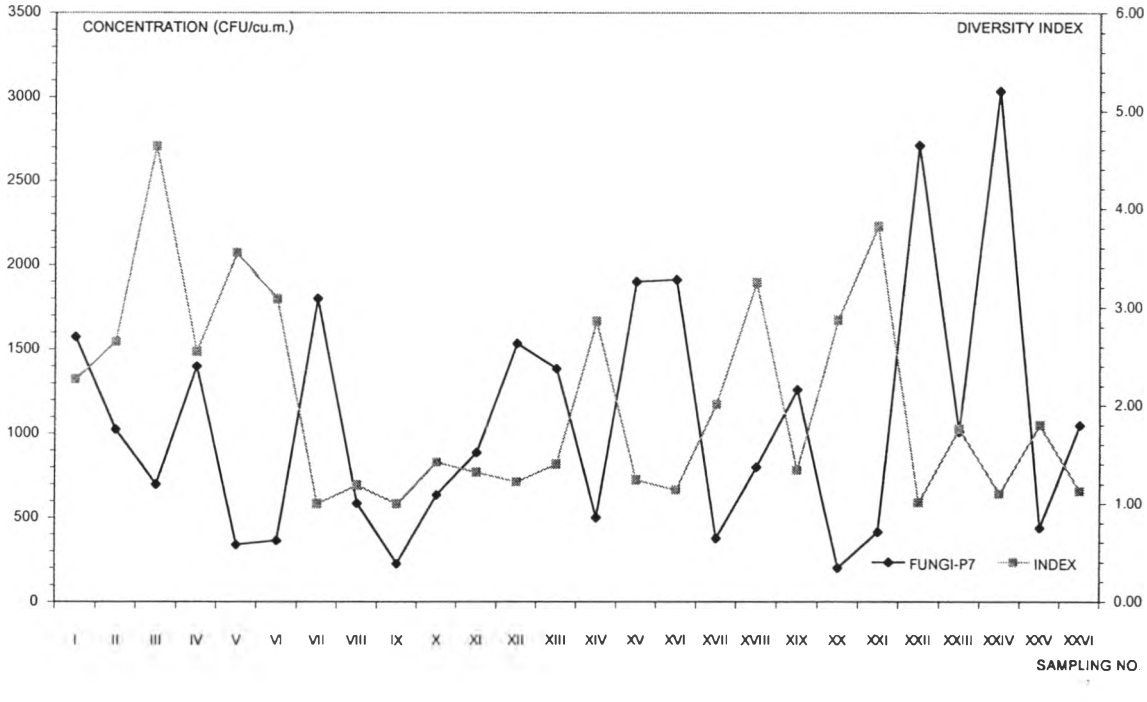

Figure 4.26: Seasonal pattern of total airborne fungi and Simpson's diversity index at P7.

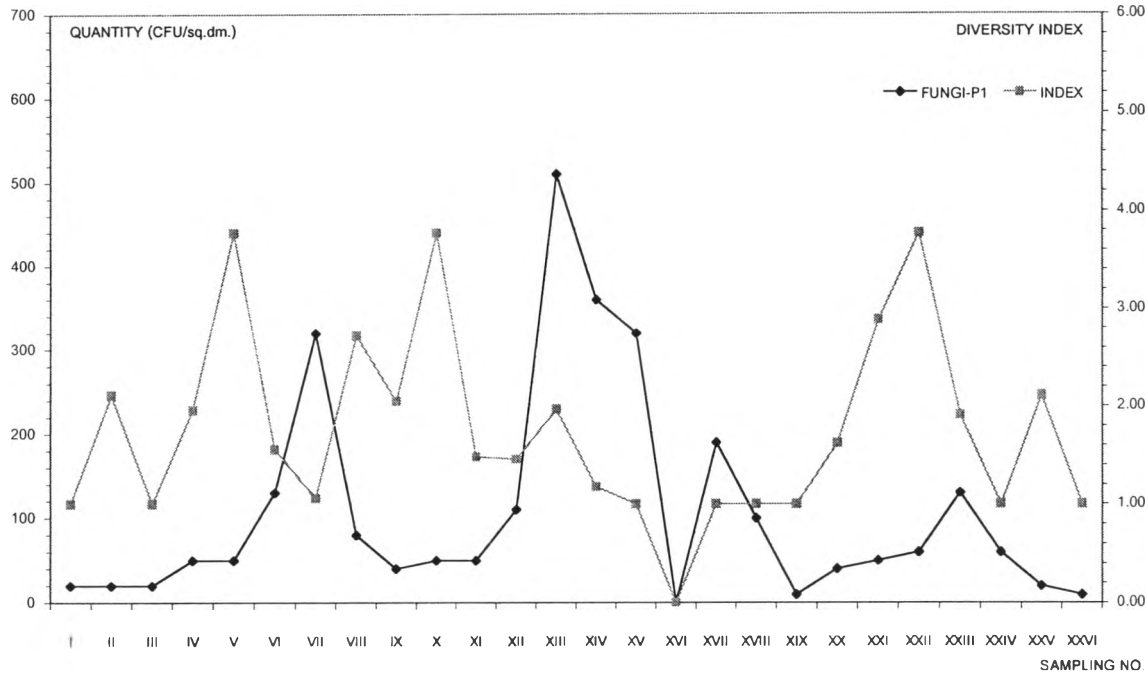

Figure 4.27: Seasonal pattern of total surface fungi and Simpson's diversity index at P1.

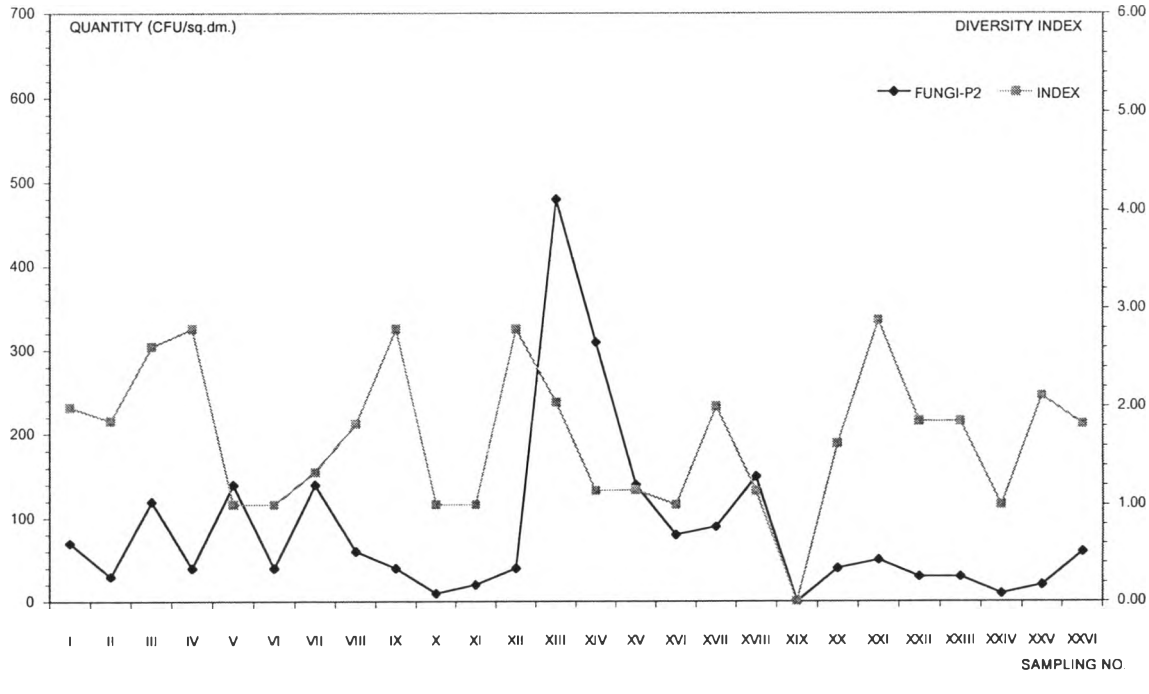

Figure 4.28: Seasonal pattern of total surface fungi and Simpson's diversity index at P2.

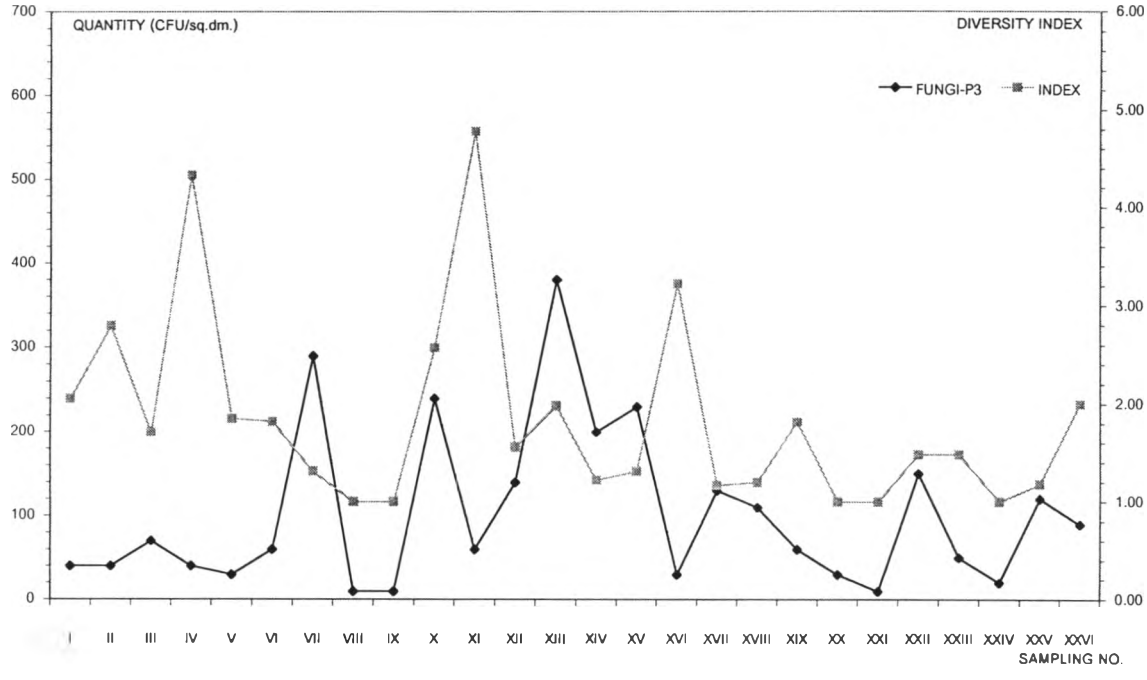

Figure 4.29: Seasonal pattern of total surface fungi and Simpson's diversity index at P3.

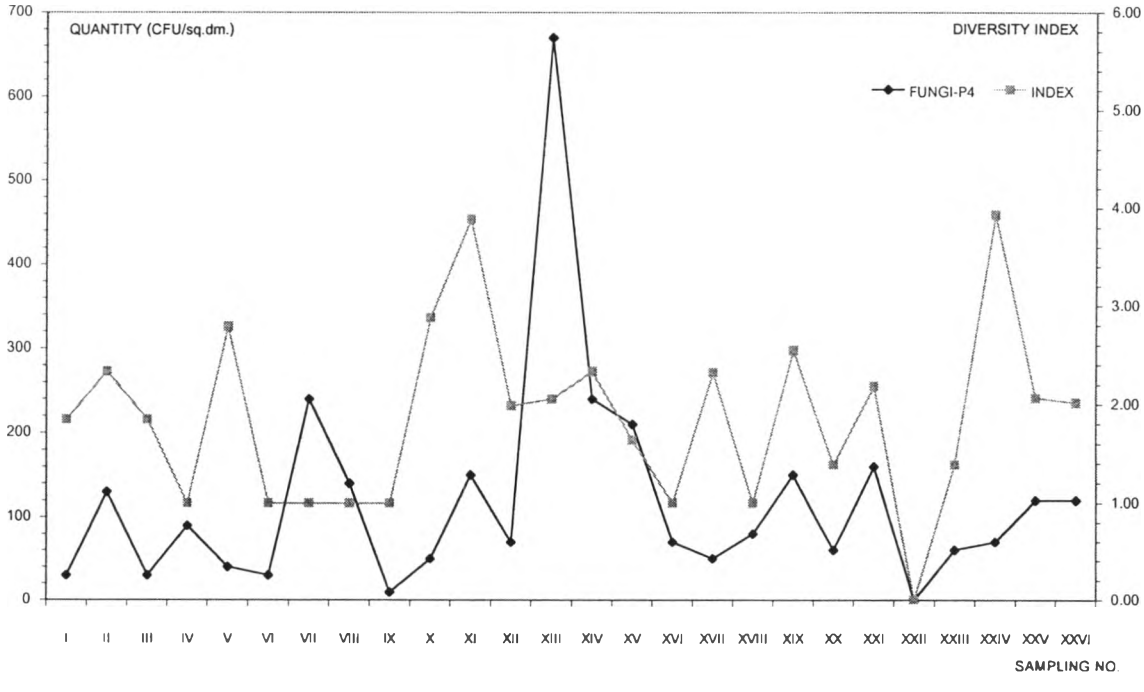

Figure 4.30: Seasonal pattern of total surface fungi and Simpson's diversity index at P4.

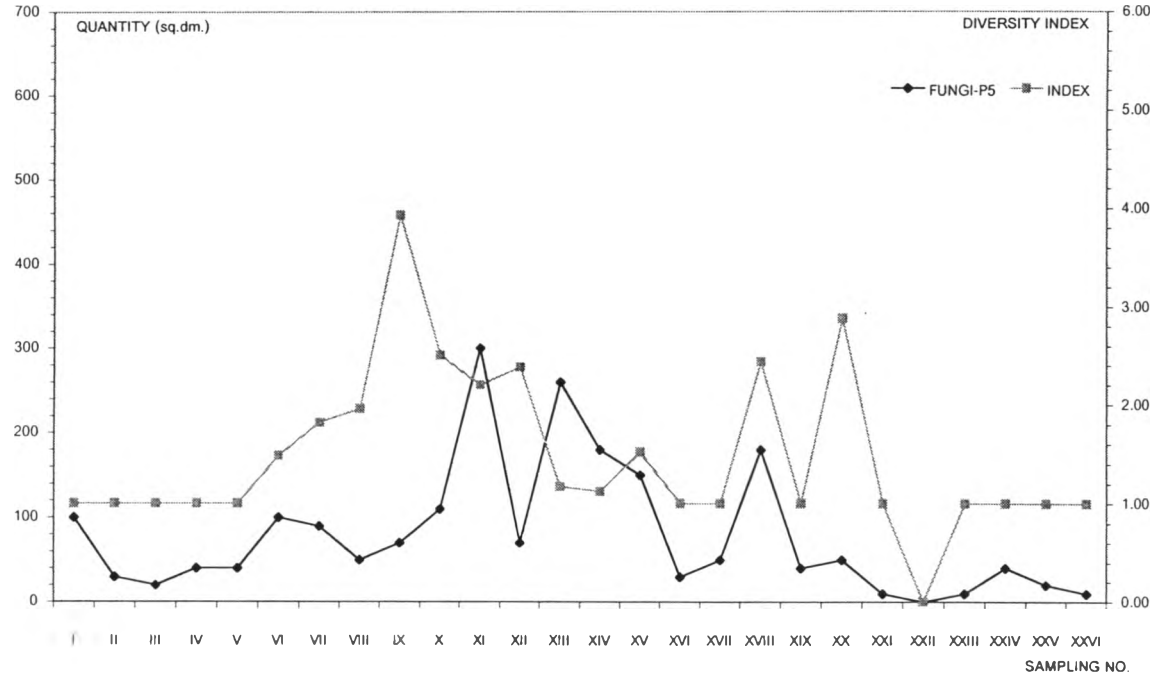

Figure 4.31: Seasonal pattern of total surface fungi and Simpson's diversity index at P5.

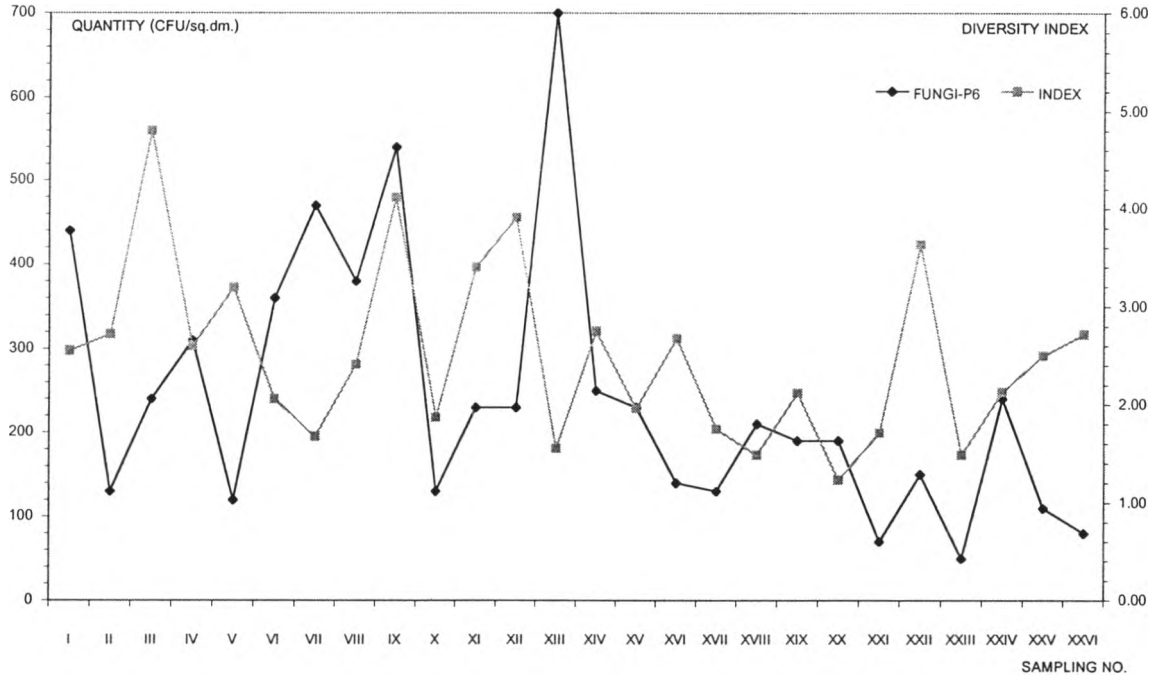

Figure 4.32: Seasonal pattern of total surface fungi and Simpson's diversity index at P6.

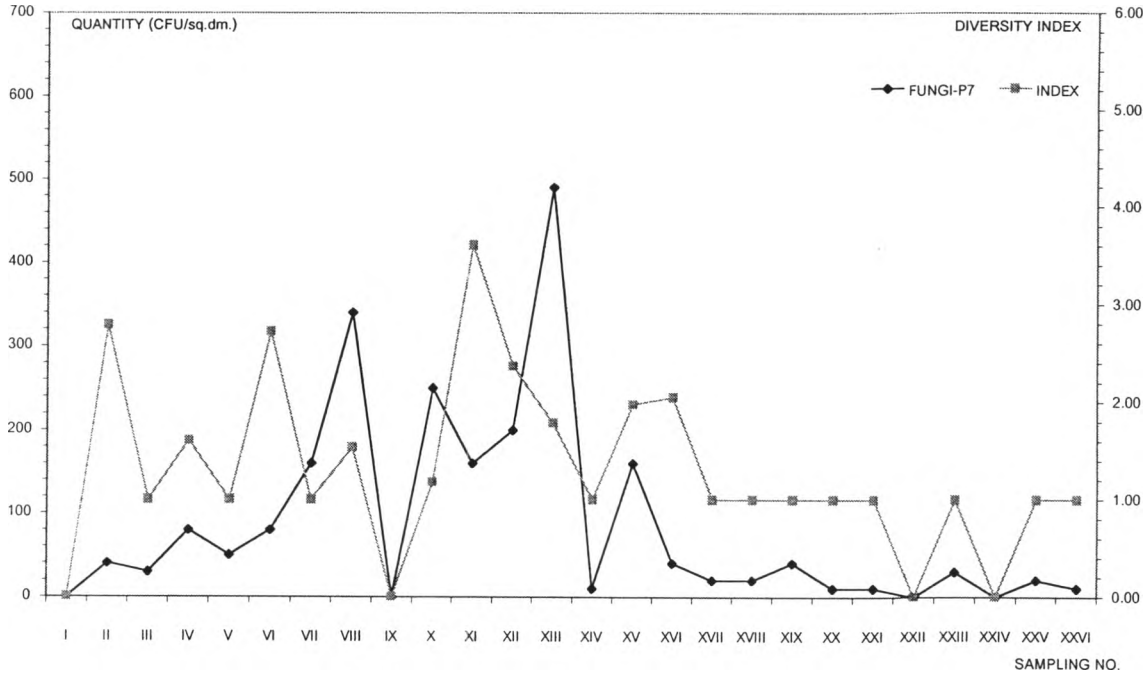

Figure 4.33: Seasonal pattern of total surface fungi and Simpson's diversity index at P7.