FIG. 1.

FIG. 2.

sensitiveness to moisture is such that it could serve for the study of the *perspiratio insensibilis* of the skin in human physiology and in pharmacology (*5*) and of leaf transpiration in plant physiology (*6*), or to record rains or dew and mist (the last two on spider webs) in meteorology (*7*).

When, in a printing frame a variegated leaf is applied on a hygrophotographic plate preliminarily blackened by exposure, the hygrophotographic image appearing on the plate exactly reproduces, under the effect of transpiration which is more active in the green parts than in the etiolated parts, the contours of the green parts, the yellow areas not yielding any impression on the plate. This phenomenon is quite striking with leaves having an active transpiration such as those of *Acer negundo* (Figs. 1 and 2), *Abutilon savitzii, Tradescantia zebrina,* and marginated leaf of *Pelargonium.* It is not appreciable with coriaceous and evergreen leaves such as those of *Aucuba japonica* or *Evonymus japonicus* the transpiration of which is extremely low.

Figure 1 shows two leaflets of variegated *Acer negundo* photographed by direct lighting of leaflets placed on the sensitive paper; green parts therefore show up in white and etiolated parts in black. Figure 2 represents the hygrophotography of these same leaflets; the green parts, which transpire actively, show up this time in black.

Examination of these images shows that chlorophyll plays an active part in transpiration by promoting the release of water vapor by the leaves.

References

1. VAN TIEGHEM, P. *Bull. soc. botan. France,* **33**, 152 (1886).
2. BONNIER, G., and LECLERC DU SABLON. *Cours de botanique,* **2**, 2448.
3. SIVADJIAN, J. *Compt. rend.,* **228**, 1296 (1949); **230**, 390 (1950).
4. ———. *Bull. soc. chim.,* **17**, 483 (1950).
5. ———. *Compt. rend.,* **234**, 1911 (1952).
6. ———. *Ibid.,* **232**, 1956 (1951); *Bull. soc. botan. France,* **99**, 138 (1952).
7. ———. *Ibid.,* **234**, 647 (1952).

Manuscript received October 10, 1952.

Numbers of Fungi and Bacteria in Transatlantic Air[1]

S. M. Pady[2] and C. D. Kelly[3]

Department of Botany and *Department of Bacteriology, McGill University, Montreal, Quebec, Canada*

Aerobiological studies of fungi and bacteria were commenced in 1947 with samples from the Canadian Arctic (*1, 2*). Early qualitative work was supplemented by techniques and apparatus designed for quantitative sampling from rapidly moving aircraft (*3*). Much variation was found in numbers of microorganisms in both temperate and arctic regions which appeared to be correlated with specific air masses (*4, 5*). To obtain further data two flights were made in June and August 1951 from Montreal, Quebec, Canada, to London, England, and return, with RCAF squadron 426 in a North Star (DC-6) aircraft. This is a preliminary report on the numbers of fungi and bacteria obtained from continuous sampling on these two trips, and, as far as the authors are aware, it is the first quantitative study of fungi and bacteria over the Atlantic Ocean.

The samplers were mounted as in previous flights (*3*), and the following samples were taken: 16 filters, 121 sets of plates in the McGill-GE sampler, and 19

[1] This work was supported by grants from the Defence Research Board, Ottawa, Canada.

[2] Present address: Department of Botany, Kansas State College, Manhattan.

[3] The invaluable technical assistance of Sharon Layne and Lucia Kapica is gratefully acknowledged.

TABLE 1

BACTERIA (B) AND FUNGI (F) PER CUBIC FOOT. FLIGHT MONTREAL, QUEBEC, TO LONDON, ENGLAND, WITH STOPOVER AT GOOSE BAY, LABRADOR, JUNE 25–26, 1951, RCAF NORTH STAR. ALTITUDE 9000 FT. FLIGHT DURATION 15 HR 30 MIN. SAMPLES—54

Flight	Air mass			McGill-GE		Slit		Filter		Fungus spores
	Type	Extent		B	F	B	F	B	F	
		Hr	Min							
Montreal to Goose Bay	Polar(?) continental	3	52					0.025	0.14	6.75
Goose Bay to London	Tropical	1	20	0.2	1.9	0.2	8.2	0.05	0.02	3.7
	Polar	5	10	0.0	0.1	0.05	0.9	0.0	0.01	1.0
	Tropical maritime	3	04	0.07	0.2	0.03	1.1	0.16	0.004	1.5
	Polar(?) maritime	1	28	0.05	0.1	0.05	0.4	0.02	0.006	—

TABLE 2

BACTERIA (B) AND FUNGI (F) PER CUBIC FOOT. RETURN FLIGHT JUNE 29–30, 1951. STOPOVERS AT ST. EVAL, CORNWALL, ENGLAND; KEFLAVIK, ICELAND; GREENWOOD, NOVA SCOTIA. FLIGHT DURATION 16 HR 55 MIN. ALTITUDE 8000 FT. SAMPLES—63

Flight	Air mass			McGill-GE		Slit		Filter		Fungus spores
	Type	Extent		B	F	B	F	B	F	
		Hr	Min							
London–St. Eval	Tropical	1	07	0.03	4.8	0.56	9.0			
St. Eval–Keflavik	Tropical	5	43	0.26	1.3	0.3	4.4	0.42	0.09	3.0
Keflavik–Greenwood	Tropical	3	00	0.25	0.6	0.26	2.1	0.05	0.02	15.1
	Polar	7	05	0.44	0.14	0.53	0.4	0.02	0.01	0.5
Greenwood–Montreal	No samples taken									

TABLE 3

BACTERIA (B) AND FUNGI (F) PER CUBIC FOOT. SECOND FLIGHT AUGUST 22–23, 1951. MONTREAL TO LONDON, WITH STOPOVER AT GOOSE BAY. FLIGHT DURATION 15 HR 14 MIN. ALTITUDE 9000 FT. SAMPLES—71

Flight	Air mass			McGill-GE		Slit		Filter		Fungus spores
	Type	Extent		B	F	B	F	B	F	
		Hr	Min							
Montreal to Goose Bay	Polar		30	0.4	1.5	0.2	2.6			
	Tropical or mod. polar	1	46	0.18	1.6	0.3	4.5	0.036	0.26	26.5
	Polar	1	44	0.10	0.6	0.2	2.0	contam	0.05	
Goose Bay to London	Tropical	1	20	0.1	0.7	0.31	6.4	0.02	0.01	2.5
	Polar	6	56	0.03	0.05	0.03	0.2	0.09	0.001	3.9
	Tropical maritime	2	58	0.04	0.2	0.04	1.4	0.03	0.003	1.2

TABLE 4

BACTERIA (B) AND FUNGI (F) PER CUBIC FOOT. RETURN FLIGHT AUGUST 26–27, 1951. STOPOVERS AT PRESTWICK, SCOTLAND, KEFLAVIK, AND GOOSE BAY. FLIGHT DURATION 15 HR 40 MIN. ALTITUDE 8000 FT. SAMPLES—72

Flight	Air mass			McGill-GE		Slit		Filter		Fungus spores
	Type	Extent		B	F	B	F	B	F	
		Hr	Min							
London to Prestwick	Tropical	1	00	0.39	1.48	1.49	6.1			16.3
Prestwick to Keflavik	Tropical	1	03	0.3	1.1	0.92	8.8			
	Polar	2	35	0.01	0.13	0.19	0.7			0.2
Keflavik to Goose Bay	Polar	7	12	0.03	0.06	0.17	0.5			0.35
Goose Bay to Montreal	Tropical mod.	3	50	0.18	0.5	0.11	0.9			361.4

plates and 25 silicone slides (*6*) in the slit sampler. Exposure length was 1–3 hr for the filters; for all others, 15–30 min over land and 30–60 min over water. Complete data for each sample were obtained from the navigator's log and from the main meteorological office of the Department of Transport at the Dorval Airport at Montreal, Quebec. Averages were made of the numbers of fungi and bacteria in the various air masses by each sampler and are summarized in Tables 1–4. Numbers of bacteria are based on colonies, those of fungi on colonies and numbers of fungus spores.

Wide variation in numbers of fungi and bacteria/cu ft is apparent from these data; it is due in part to the season of the year, the kind of samplers used, and the type of air mass encountered. More organisms were obtained in the August trip (Tables 3, 4) than in the June trip (Tables 1, 2) but the differences were not significant. The samplers varied considerably in their efficiency: for sampling fungi the filters were very inefficient, but for the bacteria, whose numbers with one exception were less than 1/cu ft, the filters were fairly satisfactory. Samples taken over land masses, particularly from Montreal to Goose Bay, had higher numbers than those taken over the ocean.

There was no diminution of organisms in the samples taken over the ocean. Colonies of fungi were present in all plates obtained, confirming the observations of Newman (*7*) over the Pacific Ocean. Bacteria were present in all samples in the August trip; in June, however, some plates had no colonies (Table 1). Fungi were more numerous than bacteria in all samples taken. The numbers obtained over the ocean are probably correlated with air masses. Polar air had very low numbers of both bacteria and fungi, whereas tropical air had higher numbers, with fungi greatly outnumbering bacteria. In one tropical air mass 8.8 fungi/cu ft were recorded from plates exposed in the slit sampler (Table 4).

Silicone slide studies revealed high numbers of fungus spores in the air. Comparison with plate counts clearly indicates the presence of large numbers of spores which are either non-viable or are unable to grow on our media. Concentrations up to 15.1/cu ft were obtained over the ocean (Table 2), and up to 361.4/cu ft over land (Table 4), while in the corresponding plates viable colonies of fungi were less than 1/cu ft. The latter air mass was identified by meteorologists as polar, but the high numbers of fungus spores indicated a tropical continental origin. It is believed that this technique might prove useful in the identification of air masses. Additional information concerning these flights will be published separately (*8*).

References

1. POLUNIN, N., PADY, S. M., and KELLY, C. D. *Nature,* **160**, 876 (1947).
2. PADY, S. M., KELLY, C. D., and POLUNIN, N. *Ibid.,* **162**, 379 (1948).
3. KELLY, C. D., PADY, S. M., and POLUNIN, N. *Can. J. Botany,* **29**, 206 (1951).
4. ——— and ———. *Can. J. Botany,* **31**, 90 (1953).
5. PADY, S. M., and KELLY, C. D. *Ibid.,* 107.
6. ———. *Science,* **110**, 187 (1949).
7. NEWMAN, I. V. *Nature,* **161**, 275 (1948).
8. PADY, S. M., and KELLY, C. D. To be published.

Manuscript received October 20, 1952.

Effect of Fungicidin (Nystatin) in Mice Injected with Lethal Mixtures of Aureomycin and *Candida albicans*

Rachel Brown, Elizabeth L. Hazen, and Alice Mason

Division of Laboratories and Research, New York State Department of Health, Albany* and *New York City

Seligmann (*1*) recently demonstrated that sublethal doses of *Candida albicans* became highly lethal when mixed with aureomycin. Fungicidin[1] has both strong fungistatic and fungicidal activity *in vitro* against *C. albicans* (*2, 3*); therefore it seemed important to investigate its effect in association with aureomycin since moniliasis is believed by some to be a significant complication of aureomycin therapy.

The fungicidin used for this work was prepared as follows: Methanol extracts of *Streptomyces noursei*[2] mycelia were concentrated *in vacuo,* and the dry residue suspended in a mixture of equal parts of 0.85% sodium chloride solution and butanol. The fungicidin suspended at the interface was collected, washed with saline, and dissolved in methanol by warming at 50–52° C. After chilling, the clarified extract was precipitated with an equal volume of saline. The precipitate was again dissolved in methanol, and the chilled and clarified solution was precipitated by the addition of 4 vol of ethyl acetate. This final precipitate was dried quickly with ether. In cup tests 3.1 μg/ml showed inhibition against *C. albicans.* For *in vivo* tests a fungicidin suspension containing 5 mg/ml was prepared as previously described (*2*). The subcutaneous dose was 0.6 ml.

The strain of *C. albicans* (No. 4657) used in the animal tests was obtained from Rhoda Benham. It was isolated from a case of generalized cutaneous moniliasis. (This culture, since its isolation in 1946, has maintained its high virulence for rabbits: 0.2 ml of a 1:100 suspension in sterile 0.85% sodium chloride solution injected intravenously regularly kills rabbits of 2 to 2.5 kg between the second and third day, with the production of multiple abscesses in the cortex of the kidney.) The growth from a 48-hr culture on Sabouraud's agar slants was washed off with sterile saline and centrifuged at 1500 rpm for 30 min. The packed cells were resuspended in sterile saline (0.1 ml cells plus 2.4 ml saline) (*1*). A dose of 0.2 ml of this suspension corresponded to approximately 100 million viable cells.

[1] The senior authors have given the name Nystatin to their product fungicidin. It is being manufactured by E. R. Squibb and Sons under this name.

[2] Actinomyces No. 48240.