

Supplement of

Ice nucleators have shorter persistence in the atmosphere than other airborne bacteria

Emiliano Stopelli¹, Franz Conen¹, Caroline Guilbaud², Jakob Zopfi³, Christine Alewell¹, Cindy E. Morris²

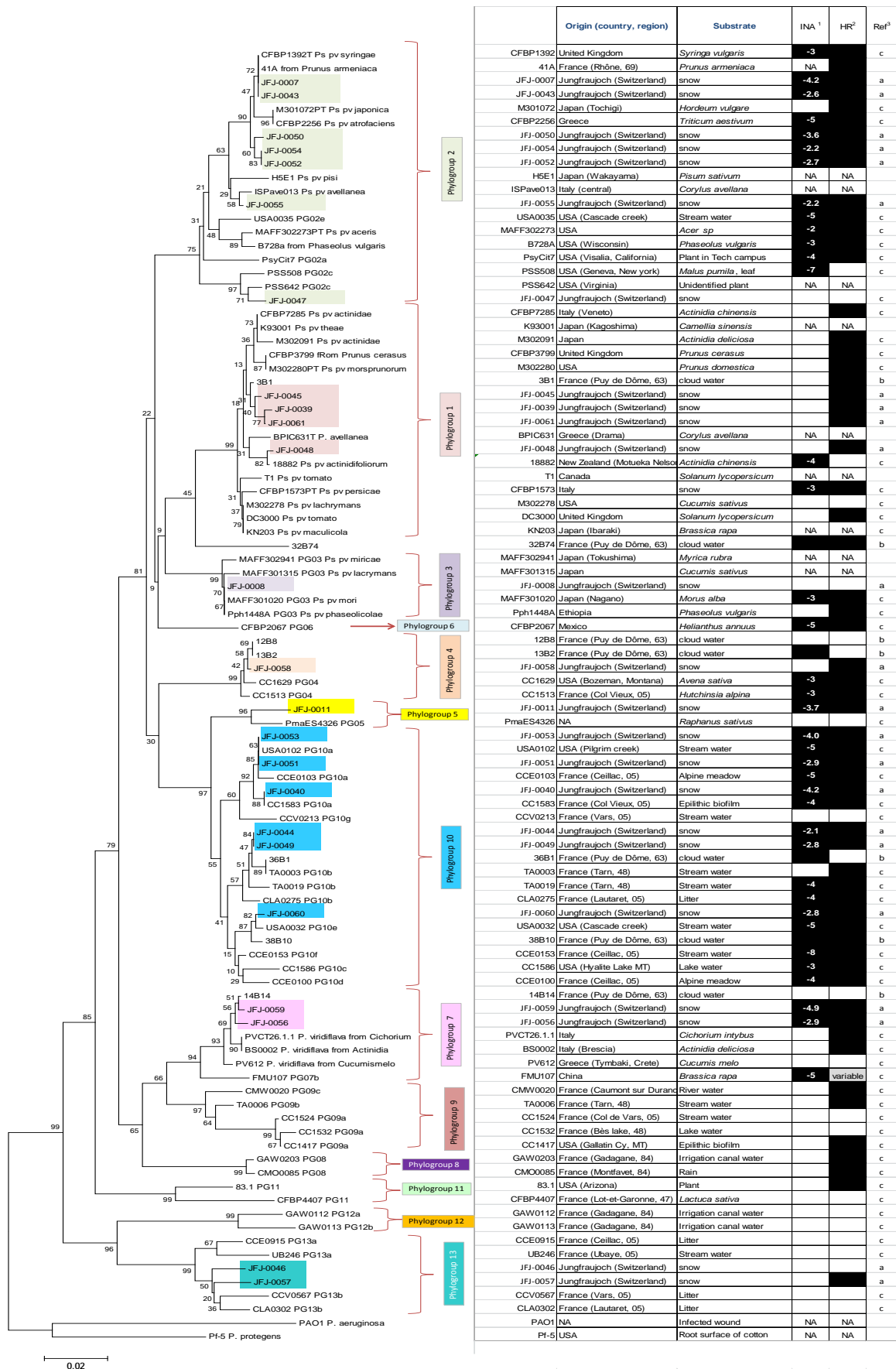
¹Environmental Geosciences, University of Basel, 4056 Basel, Switzerland

²INRA PACA, UR 0407 Plant Pathology Research Unit, 84143 Montfavet, France

³Acquatic and Stable Isotope Biogeochemistry, University of Basel, 4056 Basel, Switzerland

Correspondence to: Emiliano Stopelli (emiliano.stopelli@unibas.ch) and Franz Conen (franz.conen@unibas.ch)

Supplemental Figure 1. Neighbour joining phylogenetic tree of the strains of *P. syringae* isolated from Jungfrauoch, constructed on the basis of partial sequences of the citrate synthase housekeeping gene (*cts*) and comparison with *P. syringae* reference strains. More information is provided in section 2.2 of the article.



positive reaction	
negative reaction	
No data	NA
variable	variable

¹⁻³INA refers to ice nucleation activity of suspensions of cells via immersion freezing. The reported values are the freezing onset temperature. INA is considered positive when the onset of freezing occurred at temperatures $\geq -8^{\circ}\text{C}$. According to the reference:

- a- This study, 10^8 cells per mL in 0,9 % NaCl, 200 μL per unit analysed, corresponding to $\sim 2 \cdot 10^7$ cells.
- b- 10^7 cells per reaction in water, References:
Amato, P., Parazols, M., Sancelme, M., Laj, P., Mailhot, G., and Delort, A. M.: Microorganisms isolated from the water phase of tropospheric clouds at the Puy de Dôme: major groups and growth abilities at low temperatures, FEMS Microbiol. Ecol., 59, 242-254, doi:10.1111/j.1574-6941.2006.00199.x, 2007;
Joly, M., Attard, E., Sancelme, M., Deguillaume, L., Guilbaud, C., Morris, C. E., Amato, P., and Delort, A. M.: Ice nucleation activity of bacteria isolated from cloud water, Atmos. Environ., 70, 392-400, doi:10.1016/j.atmosenv.2013.01.027, 2013;
Väitilingom, M., Attard, E., Gaiani, N., Sancelme, M., Deguillaume, L., Flossmann, A. I., Amato, P., and Delort, A. M.: Long-term features of cloud microbiology at the Puy de Dôme (France), Atmos. Environ., 58, 88-100, doi:10.1016/j.atmosenv.2012.03.072, 2012.
- c- 10^6 cells per reaction in water, Reference:
Berge, O., Monteil, C. L., Bartoli, C., Chandeysson, C., Guilbaud, C., Sands, D. C., and Morris, C. E.: A user's guide to a data base of the diversity of *Pseudomonas syringae* and its application to classifying strains in this phylogenetic complex, PloS one, 9, e105547, doi: 10.1371/journal.pone.0105547, 2014.

²Capacity to induce a hypersensitive reaction (HR) in tobacco indicative of the presence of a functional type III secretion system that is one of the fundamental traits usually required for pathogenicity of *P. syringae* to plants.

Supplemental Table 1. This table contains all most relevant field data collected at Jungfraujoch and reported in the paper. f_v represents the fraction of residual water vapour in a precipitating air mass. More details on the calculation of all these parameters are reported at the Methods section in the article.

Date of start sampling	Start sampling (UTC)	End sampling (UTC)	Total bacteria (cells mL ⁻¹)	fraction living	INPs ₈ mL ⁻¹	f_v	Wind speed (km h ⁻¹)	Temperature (°C)	<i>Pseudomonas syringae</i> (CFU L ⁻¹)
10.03.2013	23.00 h	06.00 h	5285		0.21	0.27	13.0	-13.6	
11.03.2013	07.00 h	11.00 h	7689	0.78	0.21	0.25	10.3	-12.7	
12.03.2013	06.00 h	09.30 h	22817		0.21	0.16	6.7	-13.1	
12.03.2013	16.00 h	18.00 h	10383	0.74	2.35	0.22	11.7	-14.1	
13.03.2103	21.00 h	05.00 h	9326	0.52	1.35	0.10	23.8	-22.4	
14.03.2013	05.00 h	08.00 h	7461	0.54	2.09	0.09	38.7	-24.3	
19.04.2013	11.40 h	13.40 h	8082	0.69	1.59	0.47	19.1	-6.2	
19.04.2013	13.40 h	15.30 h	7772	0.48	0.21	0.35	13.7	-7.1	
19.04.2013	15.30 h	18.00 h	4974	0.56	3.16	0.28	21.6	-10.9	
19.04.2013	21.30 h	04.00 h	9948	0.56	0.21	0.32	14.4	-11.6	
20.04.2013	04.30 h	10.30 h	10258	0.52	8.06	0.33	56.2	-10.0	
20.04.2013	10.30 h	14.30 h	9637	0.61	0.65	0.28	48.6	-8.5	
20.04.2013	14.30 h	17.30 h	10258	0.61	1.35	0.27	40.7	-8.1	
22.05.2013	13.45 h	15.30 h	7927	0.61	0.65	0.30	31.3	-9.3	
22.05.2013	15.30 h	17.15 h	4197	0.63	1.35	0.32	33.7	-9.9	
22.05.2013	21.00 h	01.00 h	4507	0.55	1.11	0.29	28.0	-11.3	
23.05.2013	12.30 h	15.15 h	12124		18.14	0.38	15.8	-11.1	
23.05.2013	16.15 h	17.45 h	5595	0.64	0.65	0.30	19.4	-11.5	
23.05.2013	20.45 h	04.00 h	4974	0.75	1.35	0.26	27.7	-16.3	
24.05.2013	04.00 h	06.00h	6528	0.64	0.88	0.21	29.5	-17.2	
20.06.2013	01.00 h	04.00 h	67301	0.66	113.92	0.67	66.3	0.3	
20.06.2103	04.00 h	08.00 h	66679	0.55	68.09	0.55	61.9	-0.1	
20.06.2013	11.00 h	13.30 h	34972	0.67	182.55	0.46	75.2	-0.8	
20.06.2013	15.30 h	17.30 h	23081	0.35	72.09	0.48	74.8	-1.5	
20.06.2013	19.30 h	02.00 h	22460	0.45	16.13	0.53	40.2	-1.0	
07.08.2013	12.00 h	14.00 h	53312	0.63	122.98	0.78	59.8	0.4	
07.08.2013	14.00 h	16.10 h	67612	0.59	68.09	0.63	65.7	0.1	
07.08.2013	16.10 h	19.20 h	43365	0.56	434.64	0.63	76.3	-0.2	
07.08.2013	20.30 h	04.00 h	32174	0.63	37.44	0.54	60.0	0.2	
08.08.2013	06.30 h	09.30 h	7772	0.40	7.21	0.47	30.3	0.4	
08.08.2013	11.00 h	15.00 h	13989	0.51	7.21	0.43	33.6	-0.4	
08.08.2013	15.00 h	17.00 h	5751	0.70	4.04	0.52	21.0	0.2	
08.09.2013	02.00h	05.00 h	3264	0.55	2.35	0.47	42.4	-0.8	
08.09.2013	12.00 h	14.00 h	3109	0.58	6.39	0.52	27.6	-0.1	
08.09.2013	14.00 h	15.15 h	3886	0.48	3.86	0.49	16.0	-0.4	

08.09.2013	15.15 h	16.45 h	4041	0.54	32.16	0.49	11.6	-0.5	
08.09.2013	18.30 h	04.00 h	2953	0.63	3.96	0.26	16.0	-3.2	
12.09.2013	10.50 h	13.50 h	3264	0.62	1.84	0.48	17.1	-7.7	
12.09.2013	13.50 h	15.40 h	2642	0.65	2.09	0.39	14.0	-7.5	
12.09.2013	15.40 h	17.00 h	2953	0.63	1.59	0.33	17.1	-7.6	
12.09.2013	19.30 h	01.00 h	2875	0.54	2.89	0.34	19.8	-9.2	
22.05.2014	4.00h	12.00h	52691	0.74	44.48	0.72	65.8	-3.2	under 2
22.05.2014	12.00 h	20.00 h	17874	0.69	12.01	0.49	55.3	-2.8	2
22.05.2014	20.00h	4.00h	15388	0.60	31.51	0.52	58.7	-5.1	4
28.06.2014	20.00h	4.00h	5285	0.53	5.00	0.47	26.2	-1.1	under 2
29.06.2014	4.00h	10.00h	3109	0.70	0.21	0.32	19.6	-1.8	under 2
29.06.2014	10.00h	16.00h	5595	0.56	6.29	0.36	14.6	-2.8	under 2
29.06.2014	18.00h	4.00h	2642	0.76	2.35	0.29	34.3	-7.4	under 2
29.07.2014	4.00h	10.00h	5751	0.70	0.43	0.23	26.2	-2.0	under 2
29.07.2014	11.00h	15.30h	4041	0.77	1.59	0.31	28.6	-1.6	under 2
30.07.2014	4.00h	12.00h	29998	0.55	0.88	0.34	33.0	-0.4	under 2
30.07.2014	17.00h	01.00h	7305	0.55	0.88	0.30	5.4	3.2	under 2
30.09.2014	13.00h	13.45h	3575		0.21	0.41	7.6	-1.2	
01.10.2014	5.00h	6.30h	2409	0.45	1.59	0.38	17.0	-2.5	
21.10.2014	20.00h	4.00h	9948	0.61	60.51	0.39	68.0	-12.8	45
22.10.2014	6.00h	13.00h	6839	0.48	29.02	0.29	60.4	-17.0	under 2