

Project Title: Effect of human intervention on Antarctic microflora

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Abstract

Several studies have been carried out on the bacterial diversity of Antarctic lakes and soils near Maitri research station (70° 45' 01.65'' S and 11° 43' 01.45'' E) of India, located on Schirmacher Oasis. However, a comparison of bacterial diversity from various sources in and around the Bharati station (69° 24' 28.80'' S and 76° 11' 14.70'' E), Larsemann Hills, has not been undertaken. Moreover, Bharati being a new station, there is a greater scope to understand the anthropogenic effects on surrounding microflora. In the current study, soil samples were collected from the Broknes, Stornes, Bharati and near the Webster Bay regions of Larsemann Hills area. Microbial cultures were isolated from each sample on nutrient agar plates and morphologically distinct colonies were selected. Diversity indices were calculated based on the colony morphology, and it was deduced that the Bharati and Webster regions showed lower microbial diversity as compared to Broknes and Stornes peninsulas. There was no obvious anthropogenic effect on the microbial diversity of Bharati due to the presence of a permanent research station. Further study is needed to confirm this finding through detailed molecular identification and characterization of the cultures.

Keywords: Bharati; Larsemann Hills; microbial diversity.

Methods

The PI participated in the 32nd Indian Scientific Expedition to Antarctica (ISEA). Soil samples were collected from different locations at Bharati research station at Antarctica. Bharati (69° 24' 28.80'' S and 76° 11' 14.70'' E), India's newest permanent research base, is

situated on a rocky promontory fringing the Prydz Bay between Stornes and Broknes peninsula in the Larsemann Hills area (Nuruzzama et al. 2021). It is an ice-free cold Antarctic desert. Larsemann Hills is an Antarctic Specially Managed Area (ASMA no. 6) and includes Stornes peninsula, which is a proposed ASPA site. Sampling period ranged from 3rd to 11th Feb 2013. All the soil samples were stored and transported under frozen conditions to the laboratory for analysis.

The samples were resuspended in sterile saline solution, serially diluted and plated on nutrient agar medium to get isolated colonies. The plates were incubated at ambient temperature for colony growth. Well isolated and morphologically distinct colonies were selected and streaked again to get pure cultures.

Results

Soil samples were collected from different regions of Larsemann Hills, viz Broknes, Stornes, Bharati and Near Webster Bay. Several microbial colonies were obtained on the nutrient agar plates from each sample, and morphologically distinct colonies were picked up for stock culture preparation. Each morphologically different colony was considered as an OUT for calculation of diversity indices as follows (Magurran 2004):

Shannon index:

$$H = -\sum_{i=1}^n P_i \ln P_i$$

Simpson index

$$D = 1 - \sum_{i=1}^n P_i^2$$

Where, n is the total number of different OTUs in the community and P_i is the proportion of community represented by OTU i.

The number of morphologically distinct colonies (OTUs) and colonies in each OUT are shown in Table 1, while the diversity indices are show in Table 2. Both Shannon and Simpson indices show that the alpha (α) microbial diversity is highest at the Broknes, followed by Stornes, Bharati and lastly near the Webster Bay. α diversity is the mean species diversity in a site at a local scale. Thus, the Bharati site did not show any discernible anthropogenic effect on the microbial diversity in spite of the presence of human habitation in the form of a permanent research station. Further study is needed to confirm this finding through detailed molecular characterization of the isolates. The cultures isolated in the current study can further be screened for potential biotechnological applications, as Antarctica is an under-explored habitat for microbial activities.

Table 1: The distribution of colonies based on morphology in different samples

Sampling locations	Number of morphologically distinct OTUs	No of morphologically similar colonies in each OTU
Broknes (69-24-05.5 S & 76-23-40.5 E, 69-23-50.4 S & 76-23-02.4 E, 69-23-44.4 S & 76- 22-19.0 E, 69-23-54.8 S & 76- 22-47.9 E, 69-24-59.3 S & 76-21-23.8 E, 69-24-57.6 S & 76-21-18.5, 69-24-56.4 S & 76-21-19.7, 69-24-59.7 S & 76-21-14.5, 69-24-57.1 S & 76-21-13.6, 69-24-59 S & 76-20-48.5, 69-24-11.3 S & 76-19-28.8, 69-24-15.1 S & 76-18-59.5)	ANT 1	3
	ANT 2	11
	ANT 3	1
	ANT 4	24
	ANT 5	5
	ANT 6	15
	ANT 7	1
	ANT 8	2
	ANT 9	50
	ANT 10	65
	ANT 11	50
	ANT 12	50
	ANT 13	3
	ANT 14	46
	ANT 15	1
	ANT 16	1
	ANT 17	2
	ANT 18	50
	ANT 19	100
	ANT 20	1

	ANT 21	1
	ANT 22	2
	ANT 23	38
	ANT 24	1
	ANT 25	5
	ANT 26	1
	ANT 27	1
	ANT 28	1
	ANT 29	5
	ANT 30	26
Total	30	562
Bharati (69-24-53.8 S & 76-12-53.4 E, 69-24-50.3 S & 76-12-27.3 E, 69-24-44 S & 76-12-12.2 E)	ANT 31	28
	ANT 32	48
	ANT 33	6
	ANT 34	1
	ANT 35	50
Total	5	133
Near Webster Bay (69-26-00.9 S & 75-59-39.6 E, 69-26-00.2 S & 75-59-12.6 E, 69-26-6.5 S & 75-59-26.3 E, 69- 25-58.2 S & 75-59-44.9 E)	ANT 36	1
	ANT 37	12
	ANT 38	1
	ANT 39	6
	ANT 40	54
	ANT 41	1
	ANT 42	11
Total	7	86
Stornes (69-24-16.1 S & 76-06-39.1 E, 69-24-12.4 S & 76-06-43.6 E, 69-24-12.4 S & 76-06-42.2 E, 69-24-11.6 S & 76-06-33.1 E, 69-24-08.2 S & 76-06-34.6 E, 69-24-04.1 S & 76-06-48.5 E)	ANT 43	5
	ANT 44	160
	ANT 45	244
	ANT 46	24
	ANT 47	49
	ANT 48	62
	ANT 49	5
	ANT 50	1
	ANT 51	1
	ANT 52	50
	ANT 53	5
	ANT 54	3
	ANT 55	1
	ANT 56	1
	ANT 57	1
	ANT 58	1
	ANT 59	34

	ANT 60	1
	ANT 61	1
	ANT 62	11
	ANT 63	1
	ANT 64	1
	ANT 65	1
	ANT 66	3
	ANT 67	1
	ANT 68	1
	ANT 69	1
	ANT 70	1
	ANT 71	5
	ANT 72	2
	ANT 73	1
	ANT 74	1
	ANT 75	1
	ANT 76	1
	ANT 77	1
Total	35	682

Table 2: Diversity indices of different sites

Sampling locations	Shannon index	Simpson index
Broknes	2.61	0.91
Bharati	1.24	0.68
Near Webster Bay	1.17	0.56
Stornes	2.04	0.79

References:

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