

MITES ASSOCIATED WITH A FUMAROLE IN HAWAII
VOLCANOES NATIONAL PARK*

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During May 1971, several steam vents or fumaroles in the Hawaii Volcanoes National Park were sampled as part of the soil arthropod studies connected with the Hawaii International Biological Program. Only one of these fumaroles will be considered in this presentation. The fumarole in question is located 1km west of the park headquarters along Steaming Bluffs Trail and has been designated Vent II in the series of fumaroles investigated. This fumarole measures 8.3m in length and has a maximum width of 3.2m. The actual steam emitting opening is located 1.5m from the east end of the fissure at 1.7m below the surface of the ground.

A total of 81 samples were removed (Table I). Each of the samples was 10cm square and 1cm thick. Surface temperature and relative humidity were recorded for each sample at the time of removal. Samples were examined with a dissecting microscope and then processed with a Berlese funnel to extract the arthropods.

Recorded temperatures for the sample sites ranged from 25°C to 72°C. Subsequent remeasurement of temperatures over a 3 month period did not show any substantial fluctuation of temperature at individual sites. Relative humidity (RH) in the area around the fumarole at the time of sampling was 62 percent at a temperature of 25°C. Sample sites at the periphery of the fumarole ranged from 65 to 76 percent RH. The only exceptions to this were sites 38, 43, 50 and 58 which were located in a dense growth of fern, mosses and grasses. Relative humidity values at these sites ranged from 92 to 100 percent. Sites within the fumarole ranged from 92 to 100 percent RH.

An extensive analysis of the vegetational component of the fumarole has not yet been completed. A preliminary assortment of plants into 12 associations has been made and related to temperature (Table II). This association is purely of a preliminary nature.

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Twelve species of the superfamily Parasitioidea (Mesostigmata: Gamasina) have been recovered from this fumarole. These species represent seven families of free-living mites: four species of Ascidae, three of Phytoseiidae and one each of Laelapidae, Paraholaspidae, Parasitidae, Podocinidae and Rhodacaridae. The vast majority of collections containing these mites were made at temperatures between 31°C and 50°C (Table I). These collections comprise 95 percent of the total number of mites collected. A single specimen of Phytoseiidae, *Amblyseius* sp., was recovered at 40°C. Only members of the Ascidae were found in samples taken at temperatures greater than 40°C. Two species, *Cheiroseius* sp. 1 and *Cheiroseius* sp. cf. *necorniger*, were present at temperatures greater than 46°C; a single individual of *Cheiroseius* sp. 1 was found in a sample taken at 58°C. It may be significant that none of the species of Ascidae were recovered from samples taken at temperatures less than 31°C in the fumarole.

Three species of Eupodidae (Prostigmata: Eupodostigmatina) were found in the fumarole. *Eupodes* sp. 1 was found in a sample containing mosses and grass at 25°C. *Eupodes voxencollinus* Sig Thor, 1934, was also collected at 25°C from a sample of grasses. Ten specimens of a species representing an undescribed genus were recovered from samples of mosses at temperatures of 40°C and 41°C.

Discovery of mites within a fumarole represents another instance of arthropods occurring in stress environments on the island of Hawaii. Howarth (1973), Schultz (1973), Gertsch (1973), Fennah (1973), Bellinger and Christiansen (1974) and Gagné and Howarth (1975 a & b) have described various arthropods from lava tubes in the Hawaiian Islands. Fumaroles, like caves, are effectively isolated as microenvironments from the surrounding areas. In the case of the fumarole the isolating factors are temperature and high humidity. The Gamasina associated with the fumarole are from soil- and litter-inhabiting groups which are widely distributed throughout the Hawaiian Islands. The family Ascidae, which contains the species occurring at the highest temperatures within the fumarole, is well represented in the Hawaiian Islands and along the Mauna Loa transect of the island of Hawaii. The same is true of the family Eupodidae. It is noteworthy that of a total of fifteen species of Acari involved, seven species (including those found at high temperatures) and one genus represent undescribed taxa.

TABLE 1. Distribution of Mesostigmata related to temperature. Numbers in parentheses indicate numbers of individuals represented.

	21-25 °C	26-30 °C	31-35 °C	36-40 °C	41-45 °C	46-50 °C	51-55 °C	56-60 °C	61+ °C	No Temp. Data
No. of samples	2	0	10	25	24	9	2	2	5	2
No. of samples with Mesostigmata	1	0	7	12	11	3	0	1	0	1
<i>Cheiroseius</i> sp. (undescribed)			4 (7)	9 (31)	11 (39)	3 (7)		1 (1)		1 (1)
<i>Cheiroseius</i> nr. <i>necorniger</i>			2 (2)	3 (4)		1 (2)				
<i>Asca spicata</i>			1 (1)							
<i>Proctogamasellus</i> sp. (undescribed)			1 (1)							
<i>Pergamasus</i> sp.			2 (10)	1 (2)						1 (1)
<i>Typhlodromus neobakeri</i>				1 (1)						
<i>Amblyseius mexicanus</i>	1 (1)		1 (1)	3 (3)						1 (1)
<i>Amblyseius</i> sp.				1 (1)	1 (1)					
<i>Gamasiphis</i> sp.	1 (2)		3 (4)	2 (2)						1 (1)
<i>Holaspulus tenuipes</i>	1 (1)									
<i>Hypoaspis</i> <i>queenslandicus</i>			1 (2)	1 (1)						
<i>Podocinum sagax</i>	1 (1)									

TABLE 2. Vegetation related to temperature.

Plant Associations	21-25 C°	26-30 C°	31-35 C°	36-40 C°	41-45 C°	46-50 C°	51-55 C°	56-60 C°	61+ C°	No temp. data	Total no. of samples
No visible plant material				1	4	1			2		8
Algae				6	2	4	2	2	2		19
Algae, Moss					1				1		2
Algae, Moss, <i>Metrosideros</i>				1							1
Algae, Fern				1							1
Algae, Grasses				1	1						2
Moss			2	3	5	2					12
Moss, Fern	1		2		1						4
Moss, Grasses			2	2	6	1					12
Moss, Fern, Grasses	1		1							1	3
Moss, <i>Metrosideros</i>				1							1
Grasses			1	3	2	1					6
No vegetation data			2	6	2						10
Total number of samples	2	0	10	25	24	9	2	2	5	1	81

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