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MICROORGANISMS IN THE COLOURED RAIN OF SRI LANKA

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ABSTRACT

A variety of pigmented microorganisms have been identified in the red, yellow, blue and black rain that fell over Sri Lanka in December 2012 and January 2013. There is tentative evidence for the presence of similar organisms, including diatoms, in meteorites falling over the same time period. These microorganisms are likely to have served as nuclei for the condensation of rain drops.

Keywords: Red, yellow, blue and black rain in Sri Lanka, Freezing nuclei, microorganisms

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The role of microorganisms in seeding rain clouds has been recognised and studied for several decades (Maki *et al*, 1974; Maki and Willoughby, 1978; Hamilton and Lenton, 1998; Christner *et al*, 2008). Whilst inorganic dust can also produce freezing nuclei for rain, biological particles are found to be far more efficient at catalysing freezing at relatively higher temperatures. Bio-precipitation can occur as a purely Earth-bound process where colonies of bacteria are occasionally swept up by winds into the troposphere and act as nucleation sites for rain. Many microorganisms, including *Pseudomonas syringae*, are well known to serve in this way as ice nucleators, but other microbes, including those introduced by meteors and comets, could serve in this role equally well or even better (Maki *et al*, 1974).

The presence of microbial cells in the red rain of Kerala has been well documented (Louis and Kumar, 2006; Gangappa *et al*, 2010). Our own samples of red rain from Sri Lanka have shown very similar red cells to those in the Kerala rain as shown in Fig.1. The widely-stated claim that these cells (and the Kerala red rain cells) have been identified with a lichen-forming alga belonging to the genus *Trentepohlia* is totally without foundation. Extensive studies by Gangappa et al (2010) and Gangappa (2012) amongst others have concluded that the organism in question is still unidentified. It is not even clear whether the organism is a eukaryote or prokaryote at the present time (Gangappa, 2102).

During the period December 2012/January 2013 various parts of Sri Lanka experienced episodes of red rain, yellow rain, green rain as well as black rain. We have shown in an earlier paper that diatoms are present in the yellow rain and may contribute to the yellow colour of this rain (Wickramasinghe, Samaranayake, Wickramarathne et al, 2013). Extracts from the interior of the Polonnaruwa meteorite, that were also studied, showed evidence for the presence of living diatoms.

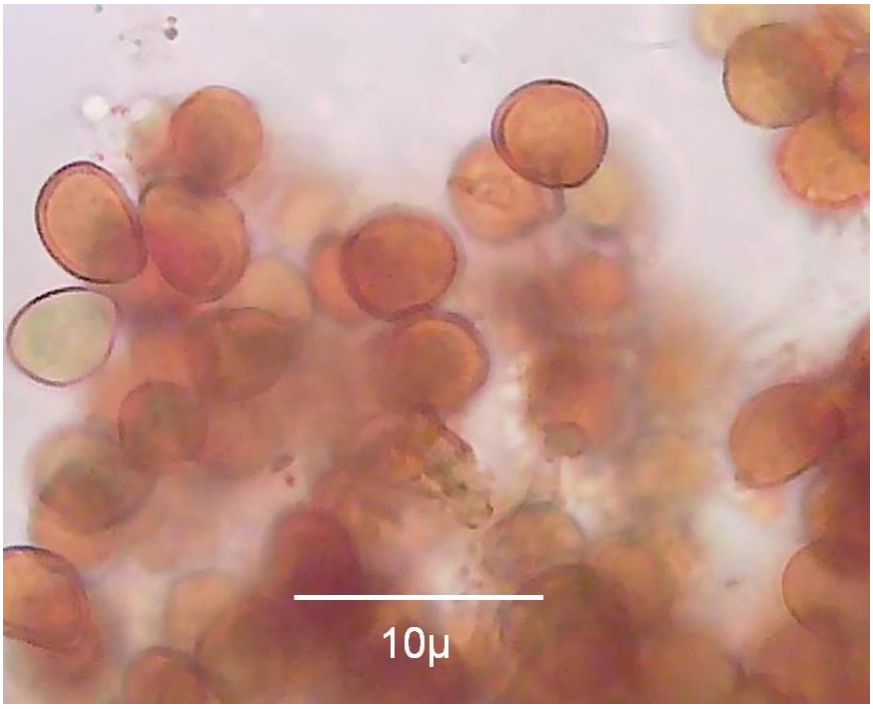

Fig.1 Red rain cells in the red rain of Sri Lanka

In this communication we present the results of microscope examination of samples of blue and black rain as well as of a sample of meteorite that fell around the same time (4 – 23 January 2013). The precise times and locations of the samples studied are shown in Table 1.

Table 1: Details of samples examined

	DATE	LOCAL TIME	PLACE
Blue rain	23-01-2013	17.00	VAVUNIYA, (VAVUNIYA DISTRICT)
Black rain	11-01-2013	15.00	MAHIYANGANAYA, MEEGAHAPITIYA (BADULLA DISTRICT)
Meteorite	04-01-2013	22.00-23.00 (fireball seen)	MAHIYANGANAYA, RAKKINDA (fallen into the garden) (BADULLA DISTRICT)

The distance between the site of the black rain and the meteorite fall is approximately 25km. The microscope images we present are of microorganisms that were found in the blue and black rain as well as in an interior sample of the meteorite. We simply show the microscope data without attempting to fit the organisms to genera and species. We are continuing to pursue these studies and the results will be published in a later communication.

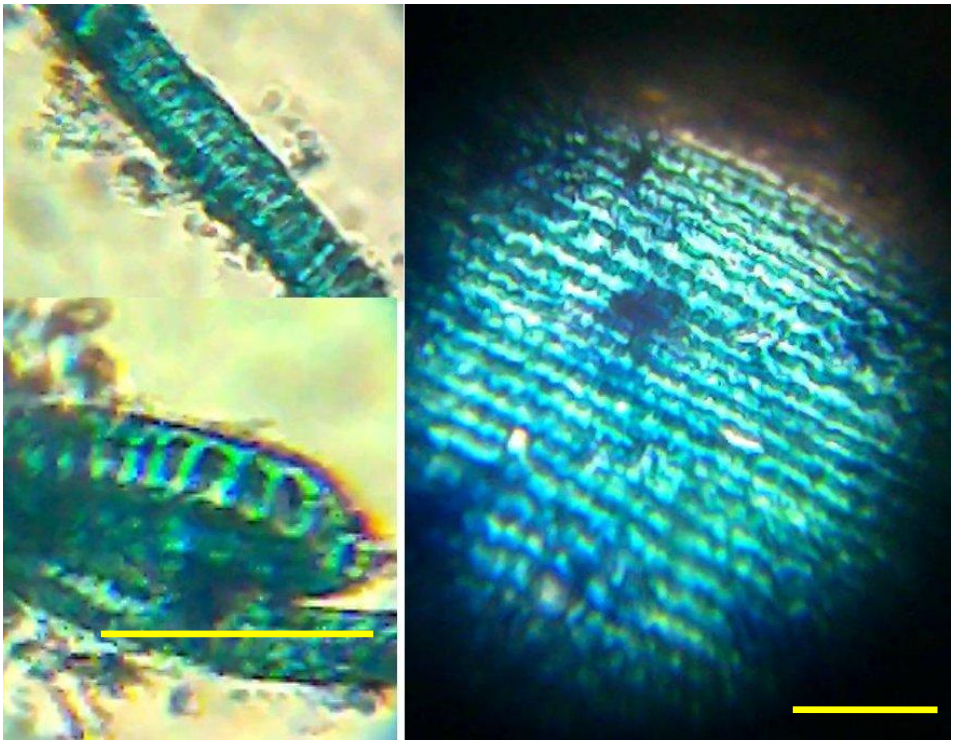

Fig.2 Microorganisms giving colour to the Sri Lankan blue rain. Bar represents 10μm.

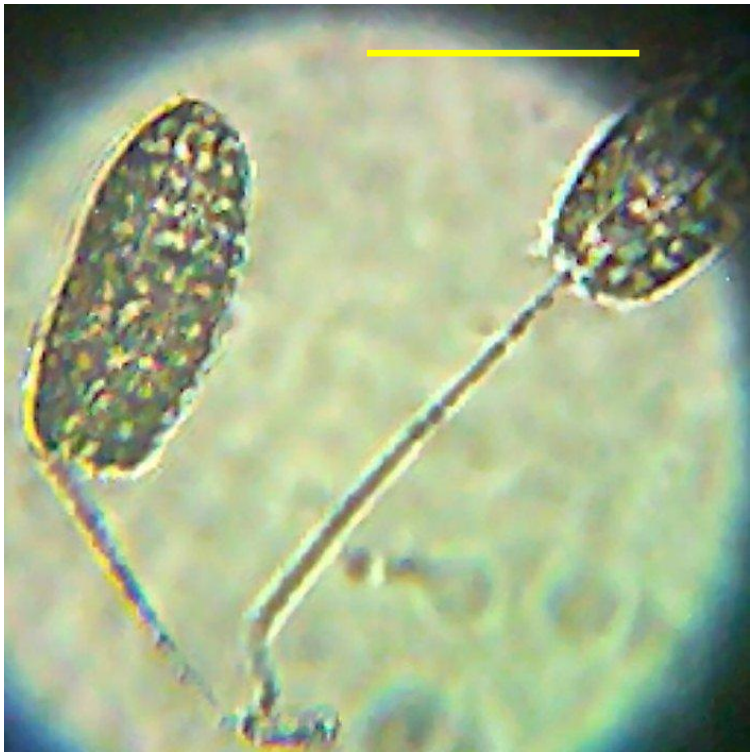

Fig.3 Microorganisms discovered in Sri Lankan black rain. Bar represents 10μm

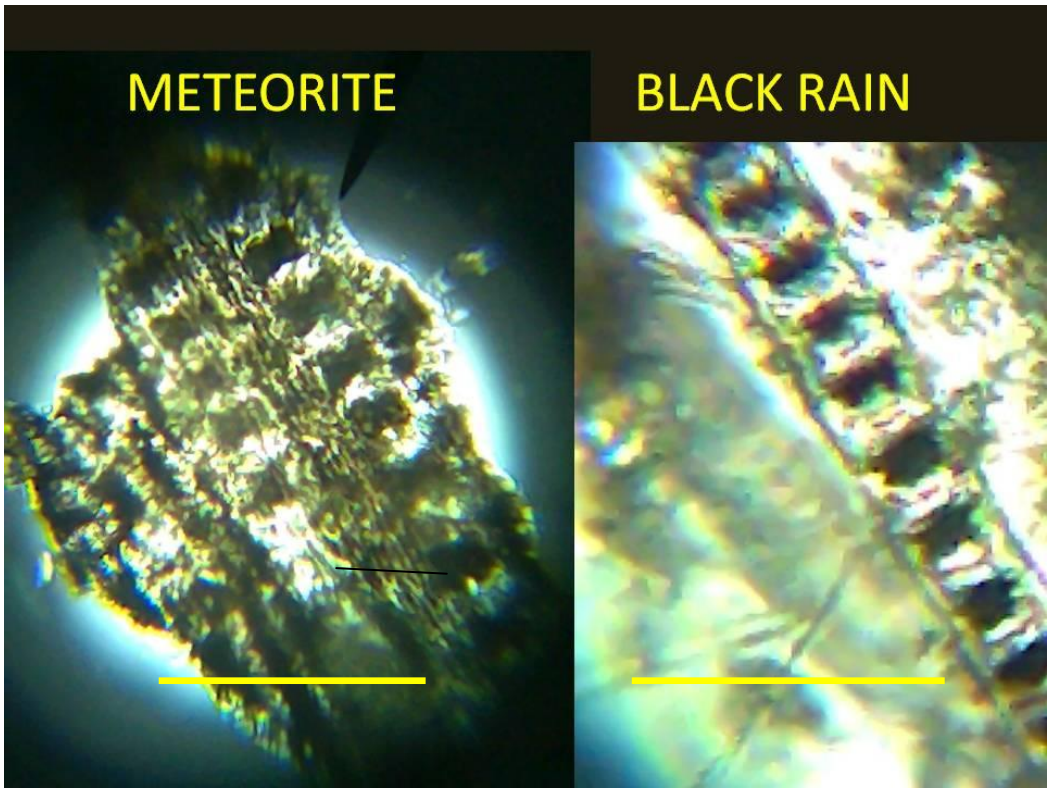

Fig.4 Microorganisms found in the Black rain and in the meteorite. Bar represents 10μm.

Figs. 2 and 3 show images of motile living microorganisms found in both the blue rain of Vavuniya and the black rain of Mahiyanganaya. Fig. 4 compares an organism found in the black rain of Mahiyanganaya with a similar structure found in the meteorite that fell in the same district a week earlier.

Whilst we cannot rule out the possibility that the microbes in the blue and black rain were lofted from the ground and returned with the rainfall, the presence of strikingly similar microbes in sterile interior extracts of the Rakkinda meteorite (Fig.4) militates against this option. We conclude that the meteorite parent bodies carried these microorganisms that were dispersed into the tropospheric clouds a week or so earlier to serve as freezing nuclei. The possibility of ongoing panspermia (Hoyle and Wickramasinghe, 2000) emerges as most reasonable option, in our view.

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