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UVC resistance in non-pigmented yeasts isolated from the Atacama Desert

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1
00:00:04,789 --> 00:00:02,389
hello everyone my name is mariani i'm a

2
00:00:06,869 --> 00:00:04,799
phd student based in brazil

3
00:00:09,110 --> 00:00:06,879
and i'll be presenting some preliminary

4
00:00:11,669 --> 00:00:09,120
results of the uvc resistance

5
00:00:14,030 --> 00:00:11,679
in non-pigmented yeasts isolated from

6
00:00:16,310 --> 00:00:14,040
the atacama desert

7
00:00:17,990 --> 00:00:16,320
microorganisms have long been known for

8
00:00:19,510 --> 00:00:18,000
their importance not only for the

9
00:00:22,230 --> 00:00:19,520
ecological balance

10
00:00:24,029 --> 00:00:22,240
but also for biotechnology processes

11
00:00:27,109 --> 00:00:24,039
this is especially true for

12
00:00:29,349 --> 00:00:27,119
extremophiles which can withstand

13
00:00:30,150 --> 00:00:29,359

extreme environmental conditions such as

14
00:00:32,430 --> 00:00:30,160
heat or

15
00:00:35,750 --> 00:00:32,440
ph and those are very useful for

16
00:00:38,069 --> 00:00:35,760
biotechnological processes

17
00:00:40,630 --> 00:00:38,079
besides thermophiles and alkali files

18
00:00:41,990 --> 00:00:40,640
the radio-resistant microorganisms have

19
00:00:44,069 --> 00:00:42,000
also been studied

20
00:00:46,389 --> 00:00:44,079
not only because of the bioproducts that

21
00:00:48,950 --> 00:00:46,399
they offer with special application

22
00:00:50,549 --> 00:00:48,960
in the pharmaceutical industry but also

23
00:00:53,350 --> 00:00:50,559
because of the recent advent

24
00:00:53,750 --> 00:00:53,360
of techniques for synthetic biology in

25
00:00:55,910 --> 00:00:53,760
which

26
00:00:57,830 --> 00:00:55,920
broadly speaking their molecular

27
00:00:58,869 --> 00:00:57,840
mechanisms of resistance could be

28
00:01:02,709 --> 00:00:58,879
applied to improve

29
00:01:05,109 --> 00:01:02,719
non-resistant microorganisms

30
00:01:05,990 --> 00:01:05,119
radio-resistant microorganisms can also

31
00:01:08,469 --> 00:01:06,000
be applied for

32
00:01:10,310 --> 00:01:08,479
studies on astrobiology including the

33
00:01:10,950 --> 00:01:10,320
better understanding of how this could

34
00:01:12,789 --> 00:01:10,960
cope

35
00:01:15,190 --> 00:01:12,799
with the extreme parameters of

36
00:01:17,030 --> 00:01:15,200
extraterrestrial habitats but also on

37
00:01:19,270 --> 00:01:17,040
primitive earth

38
00:01:21,749 --> 00:01:19,280

ultraviolet radiation is primarily

39
00:01:26,070 --> 00:01:21,759
composed of three wavelength ranges

40
00:01:28,230 --> 00:01:26,080
uva uvb and uvc only the uva and uvb

41
00:01:30,310 --> 00:01:28,240
ranges can reach the earth's surface and

42
00:01:30,950 --> 00:01:30,320
although being essential for our life on

43
00:01:33,350 --> 00:01:30,960
earth

44
00:01:35,030 --> 00:01:33,360
this can still cause direct and indirect

45
00:01:37,590 --> 00:01:35,040
deleterious effects

46
00:01:41,270 --> 00:01:37,600
such as mutagenic lesions and increases

47
00:01:43,670 --> 00:01:41,280
in the levels of reactive oxygen species

48
00:01:45,109 --> 00:01:43,680
mars on the other hand is affected also

49
00:01:48,230 --> 00:01:45,119
by the ultraviolet

50
00:01:50,389 --> 00:01:48,240
wavelengths of the uvc range uvc

51
00:01:52,469 --> 00:01:50,399
is even more deleterious leading to

52
00:01:53,350 --> 00:01:52,479
higher rates of mutations compared to

53
00:01:56,469 --> 00:01:53,360
uva

54
00:01:59,510 --> 00:01:56,479
or uvb while you still cannot take these

55
00:02:01,990 --> 00:01:59,520
organisms to be studied in sido on mars

56
00:02:03,749 --> 00:02:02,000
the so-called analogous environments are

57
00:02:06,469 --> 00:02:03,759
still a very useful way

58
00:02:09,669 --> 00:02:06,479
of understanding how organisms can cope

59
00:02:12,229 --> 00:02:09,679
with such extreme conditions

60
00:02:14,150 --> 00:02:12,239
in that regard the atacama desert is an

61
00:02:15,589 --> 00:02:14,160
analogous environment with lots of

62
00:02:18,790 --> 00:02:15,599
similar conditions

63
00:02:20,630 --> 00:02:18,800

as what we would observe in mars surface

64
00:02:23,510 --> 00:02:20,640
the high incidence of ultraviolet

65
00:02:25,670 --> 00:02:23,520
radiation is one of these parameters

66
00:02:27,910 --> 00:02:25,680
and so the study of organisms coping

67
00:02:30,229 --> 00:02:27,920
with such extreme uv levels

68
00:02:32,070 --> 00:02:30,239
is a very good way of learning more

69
00:02:34,949 --> 00:02:32,080
about how life could survive

70
00:02:36,150 --> 00:02:34,959
on mars most of the radio resistant

71
00:02:38,470 --> 00:02:36,160
microorganisms

72
00:02:41,110 --> 00:02:38,480
retrieved from the soils of the atacama

73
00:02:43,910 --> 00:02:41,120
desert are pigmented bacteria

74
00:02:46,309 --> 00:02:43,920
with melanin and carotenoids as they

75
00:02:48,550 --> 00:02:46,319
primarily found pigments

76
00:02:51,030 --> 00:02:48,560
non-pigmented microorganisms on the

77
00:02:53,350 --> 00:02:51,040
other hand still lacking studies and are

78
00:02:55,589 --> 00:02:53,360
only currently being receiving

79
00:02:57,750 --> 00:02:55,599
the deserved attention this is

80
00:02:59,030 --> 00:02:57,760
especially true for non-pigmented

81
00:03:02,550 --> 00:02:59,040
eukaryotes such as

82
00:03:04,630 --> 00:03:02,560
its east isolates therefore this study

83
00:03:05,670 --> 00:03:04,640
aimed to provide the first understanding

84
00:03:08,149 --> 00:03:05,680
of the

85
00:03:10,550 --> 00:03:08,159
resistance to utter violent radiation of

86
00:03:16,790 --> 00:03:10,560
non-pigmented extremophilic yeast

87
00:03:22,070 --> 00:03:19,110
these were isolated from the soils of

88
00:03:23,589 --> 00:03:22,080

the atacama desert back in 2012

89
00:03:25,270 --> 00:03:23,599
and two of them were already

90
00:03:28,229 --> 00:03:25,280
characterized by potion and

91
00:03:29,990 --> 00:03:28,239
collaborators in 2015.

92
00:03:32,309 --> 00:03:30,000
so here we have a picture of two

93
00:03:33,190 --> 00:03:32,319
pigmented yeasts isolated during that

94
00:03:36,149 --> 00:03:33,200
campaign

95
00:03:38,229 --> 00:03:36,159
exophiala and brothers peridot as well

96
00:03:39,750 --> 00:03:38,239
as the two non-pigmented yeasts

97
00:03:43,830 --> 00:03:39,760
naganisha fridamani

98
00:03:47,830 --> 00:03:46,149
in their paper push and collaborators

99
00:03:50,710 --> 00:03:47,840
demonstrated with raymond

100
00:03:52,869 --> 00:03:50,720
spectrometry that neither melanine nor

101
00:03:56,149 --> 00:03:52,879
carotenoids could be identified

102
00:03:57,589 --> 00:03:56,159
in the two non-pigmented isolates later

103
00:04:00,390 --> 00:03:57,599
on the team could also

104
00:04:02,550 --> 00:04:00,400
isolate eight more of the non-pigmented

105
00:04:04,869 --> 00:04:02,560
yeasts from the same samples

106
00:04:07,110 --> 00:04:04,879
these are yet to be identified and were

107
00:04:07,830 --> 00:04:07,120
used for the uvc experiments in this

108
00:04:09,670 --> 00:04:07,840
study

109
00:04:11,830 --> 00:04:09,680
so the non-pigmented yeasts were

110
00:04:15,270 --> 00:04:11,840
cultivated in yeast media for

111
00:04:17,670 --> 00:04:15,280
48 hours at 25 degrees celsius

112
00:04:19,749 --> 00:04:17,680
and then replicated to solid media for

113
00:04:22,629 --> 00:04:19,759

the uvc exposure

114
00:04:25,030 --> 00:04:22,639
48 hours after the exposure the colony

115
00:04:26,710 --> 00:04:25,040
farming units were counted and compared

116
00:04:28,950 --> 00:04:26,720
to non-exposed

117
00:04:31,510 --> 00:04:28,960
control colon because we don't have a

118
00:04:33,430 --> 00:04:31,520
radiometer in our lab we use the growth

119
00:04:35,110 --> 00:04:33,440
of the previously characterized

120
00:04:37,909 --> 00:04:35,120
naganisha predomini

121
00:04:39,189 --> 00:04:37,919
as a pattern to estimate the uvc fluency

122
00:04:40,790 --> 00:04:39,199
being used

123
00:04:44,310 --> 00:04:40,800
so as you can see in these graphs

124
00:04:47,590 --> 00:04:44,320
naganisha's growth is reduced in one log

125
00:04:50,710 --> 00:04:47,600
order after 30 seconds of exposure

126
00:04:51,830 --> 00:04:50,720
which falls well into the 0.6 kilojoules

127
00:04:55,510 --> 00:04:51,840
per square meter

128
00:04:57,909 --> 00:04:55,520
observed on pushon's experiment likewise

129
00:05:00,070 --> 00:04:57,919
after 60 seconds of exposure

130
00:05:02,230 --> 00:05:00,080
naganisha's growth is reduced to

131
00:05:04,150 --> 00:05:02,240
one-third of the original growth

132
00:05:05,990 --> 00:05:04,160
endorsing the estimates of a double

133
00:05:09,749 --> 00:05:06,000
fluency of 1.2

134
00:05:11,990 --> 00:05:09,759
kilojoules per square meter

135
00:05:14,710 --> 00:05:12,000
thus we can conclude that naganisha's

136
00:05:16,150 --> 00:05:14,720
survival cfu numbers can be used as a

137
00:05:18,790 --> 00:05:16,160
reliable pattern

138
00:05:21,670 --> 00:05:18,800

for estimating the uvc fluids for our

139
00:05:24,070 --> 00:05:21,680
our experiments

140
00:05:26,070 --> 00:05:24,080
then we exposed all us isolates

141
00:05:30,310 --> 00:05:26,080
intruplicates to the same uvc

142
00:05:33,110 --> 00:05:30,320
fluences of 0.6 and 1.2 kilojoules

143
00:05:35,110 --> 00:05:33,120
per squared meter and we can see from

144
00:05:35,590 --> 00:05:35,120
this graph that most of the isolates

145
00:05:38,070 --> 00:05:35,600
present

146
00:05:38,950 --> 00:05:38,080
a singular resistant pattern to what's

147
00:05:41,990 --> 00:05:38,960
observed

148
00:05:43,909 --> 00:05:42,000
with naganesha some of the yeasts even

149
00:05:45,590 --> 00:05:43,919
presented a potentially higher

150
00:05:46,790 --> 00:05:45,600
resistance compared to naganisha

151
00:05:49,189 --> 00:05:46,800
frederimani

152
00:05:50,790 --> 00:05:49,199
this is especially true for the 13b

153
00:05:53,670 --> 00:05:50,800
isolate with a reduction

154
00:05:56,550 --> 00:05:53,680
of only one log fold even after exposure

155
00:05:58,309 --> 00:05:56,560
to the highest uvc dose

156
00:06:00,230 --> 00:05:58,319
in conclusion we can state that the

157
00:06:02,710 --> 00:06:00,240
growth pattern observed for naganisha

158
00:06:05,590 --> 00:06:02,720
fregimony after uvc exposure

159
00:06:06,870 --> 00:06:05,600
can be used as an estimate for total uvc

160
00:06:09,510 --> 00:06:06,880
fluency

161
00:06:11,990 --> 00:06:09,520
east isolate 13b presented the highest

162
00:06:14,309 --> 00:06:12,000
uvc resistance and provides a powerful

163
00:06:17,430 --> 00:06:14,319

potential for further studies

164
00:06:18,950 --> 00:06:17,440
all other es isolates presented overall

165
00:06:21,430 --> 00:06:18,960
resistance to uvc

166
00:06:23,990 --> 00:06:21,440
and endorse the potential of desert

167
00:06:25,270 --> 00:06:24,000
non-pigmented yeasts as radio-resistant

168
00:06:27,350 --> 00:06:25,280
organisms

169
00:06:29,029 --> 00:06:27,360
these isolates shall be further explored

170
00:06:31,830 --> 00:06:29,039
for the potential

171
00:06:33,350 --> 00:06:31,840
sources of bioproducts with importance

172
00:06:35,749 --> 00:06:33,360
for biotechnology

173
00:06:38,790 --> 00:06:35,759
as well as for their potential as role