Phenotypic Characteristics of Microbes from a Freshwater Creek

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Abstract

In an ongoing study to survey the microbial population of local freshwater creeks, samples of water and sediment were collected from the Lycoming Creek near where it empties into the Susquehanna River. Colonies were isolated on a variety of media, the 16S rRNA gene was amplified using PCR and then sequenced to identify the species. Our goal was to compare traits observed with our isolated strains to those reported in Bergey's Manual and/or the original species descriptions in the literature to examine the amount of inter-strain variation within a species, and to determine which traits tend to vary within the same species. We examined the metabolism of certain carbohydrates, the use of oxygen, nitrate, urea, the growth of strains of different selective and differential media, growth at different temperatures, and also tested for the production of exoenzymes.

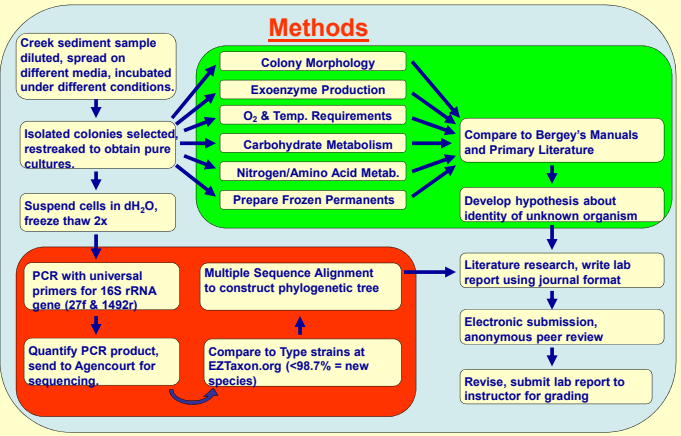
The majority of the strains isolated were gamma-proteobacteria and species of *Bacillus*. Several of the *Bacillus* strains differed from the literature in the Vogues-Proskauer and Citrate metabolism tests. Several discrepancies were found in *Chromobacterium aquaticum* strain AEM-19, *Aeromonas hydrophila* strain ABI-10, *Aeromonas ichthiosmia-veronii* strains AEM-06 and AEM-14 , *Aeromonas media-hydrophila* strain AH-20, *Aeromonas popoffii* strains AA30-16 and AH-11. The differences in phenotypes of these strains suggest that they could be novel species and merit more detailed analysis.

Microbial Population Survey in Local Creeks

Project Objectives:

- Engage students in an investigative research experience.
- Minimize the risk of working with pathogenic organisms.
- Develop a systematic but inexpensive method to characterize large numbers of cultured bacterial isolates.
- Expand the lab collection of characterized microbes
- DISCOVER NOVEL BACTERIAL SPECIES!!!!
- Identify interesting candidates for future phenotype microarray analysis and genome sequencing.

Methods



			oxygen			carbohydrates					nitrogen			temperature				exoenzymes				differential and selective media							
species	strain	16S rRNA % ID	Gas Pak	catalase	oxidase	acid glucose	gas glucose	Methyl Red	VP (acetoin)	citrate	urease	nitrate reduction	4°	20°	37°	45°	lipase	amylase	caseinase	hemolysis	EG	EMB	HEA	MSA	endo	Msc Conkey	phenyl ethanol
Cellulomonas hominis	ALK-01	99.6	w+		-	-	-	+	-	-	-	+	-		+	-	-	-	-	-	+	+	-	-	-	-	-
Microbacterium maritypicum-oxydans	AA30-09	100	-	+	+	-	-	-		+	-	-	+	+	+	-	-	-	+	-	+	+	green	-	pink	+	+
Sediminibacterium novum	AE44-14	92.3	-	+	-	-	-	-	-	-	-	-	-		+	+	+	-	w+	b+a	+	+	green	-	-	-	+
Bacillus aerophilus	AA30-06	100	-	+	+	+	-	w+		-	-	denit	-	+	+	+	+	-	+	b	-	pink	-	+	-	-	+
Bacillus aerophilus	ABI-01	100	-	+	+	+	-	-		-	-	-	-	+	+	+	-	-	+	b	w+	w+	-	+	-	+	+
Bacillus aerophilus	ABI-18	100	-	+	+	+	-	-	w+	-	-	-	-	+	+	+	+	-	+	b	-	w+	-	+	-	-	+
Bacillus cereus-thuringiensis	AArt-06	100	-	+	+	+	-	+		-	-	+	-	+	+	-	-	+	+	b	-	pink	-	-	-	-	+
Bacillus cereus-thuringiensis	ABI-20	100	-c	+	+	+	-	+		-	-	+	-	+	+	-	-	+	+	b	-	pink	-	w+	-	-	+
Bacillus cereus-thuringiensis	AEM-10	99.6	w+	+	+	-	-	+	-	-	-	+	-		+	-	-	+	+	b+a	+	pink	-	-	-	-	+
Bacillus cereus-thuringiensis	ALAm-08	100	-	+	+	+	-	w+	-	-	-	+	-	+	+	-	-	+	+	b	w+	pink	-	-	w+	w+	+
Bacillus cereus-thuringiensis	ALAm-10	100	+	+	+	-	-	+	-	-	-	+	-		+	-	-	+	+	b+a	-	pink	-	-	-	-	+
Bacillus flexus-megaterium	AE44-07	98.8	-	+	-	+	-	-	-	-	-	-	-		+	-	w+	-	+	wa	-	+	-	-	-	-	+
Bacillus licheniformis	AE44-17	99.7	-	+	+	+	-	-	-	-	-	+	-	w+	+	+	-	+		-	+	w+	-	+	-	-	+
Bacillus licheniformis	AEM-03	99.9	w+	+	+	+	-	+	w+	-	+	+	+	+	+	+	-	-	-	a	w+	+	w+	+	purple	+	+
Bacillus licheniformis	AE44-12	99.7	-	+	-	+	-	-	-	-	-	+	-	w+	+	+	-	+	-	-	+	+c	-	+	+c	-	+
Bacillus licheniformis	AE44-19	99.6	-	+	-	-	-	+	-	-	-	+	-		+	c	-	-	-	-	+	+	-	-	-	-	+
Bacillus licheniformis	AE44-20	99.1	-	+	w+	+	-	w+	-	-	-	+	-		+	+	-	w+	-	a	+	w+	-	+	-	-	+
Bacillus pumilis-safensis	AArt-15	100	-	+	+	-	-	-	-	+	-	-	+	+	+	+	-	-	-	b	+	pink	green	-	purple	+	+c
Bacillus pumilis-safensis	AEM-04	100	-	+	+	+	-	-	-	-	-	+	-	+	+	+	-	-	+	a	w+	w+	-	+	-	-	+
Bacillus pumilis-safensis	AEM-09	100	-	+	-	-	-	-	-	-	-	-	-		+	+	-	-	+	a	-	+	-	-	-	-	+
Lysinibacillus fusiformis	AA30-02	99.9	-	+	+	-	-	-		-	+	-	-	+	+	+	+	-	-	-	-	w+	-	-	-		+
Staphylococcus wameri	ABI-08b	100	+	+	-	+	-	+		-	-	-	-	+	+	-	+	-	+	-	-	pink	white	+	-	w+	+
Rhizobium radiobacter	AEM-15	99.6	-	-	-	+	-	-	+	-	-	-				-	-	-	-	-	W+	+	-	-	-	w+	-
Chromobacterium aquaticum	AEM-19	99.1	w+	-			-	-	-	+	-			+	+	+	-	-	+	a	+	pink	green	-	pink	+	-
Chromobacterium haemolyticum	AA30-11	98.9	-	+	+		-	-		+	-		+	+	+	+	-	-	+	a	+	+	green	-	purple	+	+
Aeromonas allosaccharophila	AA30-17	99.9	+	-	-	+	+	+	w+	+	-	+	-	+	+	+	-	-	w+	a	w+	+	orange	-	purple	+	w+
Aeromonas allosaccharophila	AA30-18	99.9	+	-	+	+	+	-	+	+	-	+	-	+	+	-	+	w+	+	a	w+	purple	orange	-	purple	+	+
Aeromonas allosaccharophila	AAan-02	99.7	w+	+	+	-	-	+	-	+	-	+	-	+	+	-	+	w+	+	a	w+	purple	orange	-	purple	+	+
Aeromonas allosaccharophila	AEM-18	99.7	+	-	-	+	+	+	-	+	-	+	-	+	+	-	+	+	+	a	w+	purple	orange	-	purple	+	+
Aeromonas allosaccharophila	ALAm-01	100	+	w+	-	+	+	+	-	+	-	+	-	+	+	-	+	w+	+	a	w+	purple	orange	-	purple	+	+
Aeromonas allosaccharophila	AA30-05	99.9	+	-	+	+	+	+		+	-	+	-	+	+	-	-	-	+	-	-	pink/purple	orange	-	purple	+	w+
Aeromonas encheleia-molluscorum	AArt-16	99.5	+	+	+	-	-	-	+	+	-	+	-		+	-	+	+	+	b+a	+	pink	yellow	-	pink	+	+
Aeromonas encheleia-molluscorum	ABI-02	99.7	+	+	+	+	+	-		+	-	+	-	+	+	-	-	+	+	b	+	+c	green	-	pink	+	w+
Aeromonas hydrophila	AA30-13	99.4	+	+		+	-	-		+	-	+	+	+	+	-	+	+	+	b	+	+	green	-	purple	+	w+
Aeromonas hydrophila	AA30-20	99.9	+	+	+	+	+	-	+	+	-	+	-	+	+	-	+	+	+	b	+	+	green	-	pink	+	+
Aeromonas hydrophila	ABI-04	99.9	+	+	+	+	+	-		+	-	+	-	+	+	-	-	+	+	b	+	pink	yellow	-	pink	+	w+
Aeromonas hydrophila	ABI-10	100	+	+	+	-	-	-	+	+	-	+	-		+	-	-	+	+	a	+	white	green	+	pink	+	+
Aeromonas hydrophila	ABI-03	99.9	+	+	+	+	+	-		+	-	+	-	+	+	-	-	+	+	b	+	pink	green	-	pink	+	w+
Aeromonas hydrophila	AH-06	99.9	+	+	+	+	+	-		+	-	+	-	+	+	-	-	+	+	b	+	pink	yellow	-	pink	+	+
Aeromonas ichthiosmia-veronii	AArt-19	99.9	+	w+	-	+	+	-	+	+	-	+	-	+	+	-	+	+	+	b	+	purple	yellow	-	purple	+	+
Aeromonas ichthiosmia-veronii	AEM-06	99.7	+	-	+	-	-	-	+	+	-	+	-		+	-	+	+	+	b+a	+	pink	yellow	-	-	+	+
Aeromonas ichthiosmia-veronii	AEM-14	99.6	+	-	+	-	-	-	+	+	-	+	-		+	-	+	+	+	b+a	+	purple	orange pink	-		+	+
Aeromonas ichthiosmia-veronii	AH-02	98.8	+	+	+	+	+	-		+	-	+	-	+	+	-	-	+	+	b	+	purple	yellow	-	purple	+	w+
Aeromonas ichthiosmia-veronii	AH-03	99.7	+	+	w+	+	+	+		+	-	+	-	+	+	+	-	-	+	a	-	purple	yellow	-	purple	+	+
Aeromonas ichthiosmia-veronii	AH-05	99.6	+	+	w+	+	+	-		+	-	+	-	+	+	-	-	+	+	b	+	pink	yellow	-	green	+	w+
Aeromonas ichthiosmia-veronii	AH-12	99.7	+	w+	w+	+	+	+		+	-	+	-	+	+	-	-	-	+	a	-	-	green	-	purple	+	w+
Aeromonas media-hydrophila	AH-20	99.7	+	+	+	+	+	-		+	-	+	-	+	+	+	-	+	+	b	+	pink	yellow	-	pink	+	+c
Aeromonas popoffii	AA30-14	98.6	w+	w+	-	+	+	+	+	+	-	+	+	+	+	-	+	-	+	a	-	w+	green	-	-	+	-
Aeromonas popoffii	AA30-19	98.9	w+	+	-	+	+	+	w+	+	-	+	+	+	+	+	-	-	-	a	w+	-	green	-c?	-	+	+
Aeromonas popoffii	AAan-01	98.7	+	w+	-	+	+	+	-	+	-	+	-	+	+	-	-	-	-	a	w+	w+	green	-	-	+	-
Aeromonas popoffii	AA30-16	98.9	-	+	-	+	+	w+	+	+	-	+	-	+	+	-	-	-	-	a	w+	w+	green	+	-	+	+
Aeromonas popoffii	AH-10	99	+	+		+	-	w+		+	-	+	+	+	+	-	-	-	+	b	-	-	green		+c	+	w+
Aeromonas popoffii	AH-11	99	w+	+	+	-		+	+	+	-	+	+		+	+	-	w+	w+	-	+	-	green	-	-	+	+
Cronobacter dublinensis	AAan-04	98.7	+	+	-	+	+	+	-	+	-	+	-	+	+	+	-	-	-	a	+	green	pink	+	pink	+	+
Enterobacter asburiae	AAan-07	99.3	w+	+	-	+	+	-	+	+	-	+	-	+	+	-	-	-	-	a	+	pink/purpl	orange	-	pink	+	w+
Enterobacter asburiae	AAan-08	98.6	+	w+	-	+	+	-	+	+	-	+	-	+	+	-	-	-	-	a	+	pink	yellow	-	pink	+	w+
Enterobacter asburiae	AEM-17	99.3	+	w+	-	+	+	-	+	+	-	+	-	+	+	-	-	w+	-	a	+	pink	yellow	-	pink	+	-
Enterobacter asburiae	AH-15	99.4	+	+	w+	+	+	-		+	-	+	+	+	+	+	-	+	+	b	+c	pink	green	+c	pink	+	+c
Enterobacter hormaechei	AE44-10	99.5	+	+	-	-	-	-	+	+	-	+	-		+	-	-	-	-	a	+	white	green	-	pink	+	w+
Enterobacter hormaechei	AH-16	99.7	+	+	+	+	+	-		+	-	+	+	+	+	+	-	-	+	b	+c	pink	green	+c	pink	+	+c
Obesumbacterium proteus	AH-07	98.5	+	+	-	+	+	-		-	-	+	+	+	+	-	-	-	+	a	+	+	green	-	pink	+	w+
Salmonella enterica	AArt-17	98.8	+	+	+	-	-	+	+	+	-	+	-		+	-	+	+	+	b+a	+	pink	Orange pink	-	pink	+	+
Yersinia massiliensis	AAan-05	98.4	+	w+	-	+	-	w+	w+	-	+	+	+	+	w+	-	-	-	-	a	w+	+	Green	-	purple	+	-
Yersinia massiliensis	AArt-01	98.4	+	+	-	-	-	+	+	-	+	+	+		+	-	-	-	-	wa	W+	w pink	-	-	pink	+	-
Pseudomonas alcaligenes	AArt-20	100	-	+	+	-	-	-	-	+	-	-	+	-	+	+	-	-	+	b	+	+	green	+	-	+	+
Pseudomonas alcaligenes	AH-18	100	-	+	w+	-	-	-		+	-	-	+	+	-	-	-	-	+	a	+	+	green	-	pink	+	-
Pseudomonas alcaligenes	AE44-01	98.7	-	-	w+	-	-	-	+	+	-	+	-	w+	w+	-	+	-	-	a	w+	w+	green	-	w+	+	-
Pseudomonas corrugata-kilonensis	AE44-08	99.7	-	-	+	+	-	-	-	+	-	-	+		-	-	-	-	-	a	+	white	green	-	pink	+	-
Pseudomonas costantinii-lurida	AA30-10	99.8	-	+	+	+	-	-		+	-	-	-	+	+	+	-	-	+	-	+	+	green	-	pink	+	-
Pseudomonas japonica	AA30-12	99.1	-	+	-	-	-	-		+	-	+	+	+	+	+	+	-	-	a	+	+	green	-	purple	+	+
Pseudomonas koreensis	AArt-18	99.7	+	+	+	-	-	-	-	+	-	W+	+		+	-	+	-	-	a	+	pink	green	-	purple/pink	+	-
Pseudomonas meridiana-antarctica	AH-17	99.6	-	+	w+	-	-	-		+	-	-	-	+	+	-	-	-	+	a	+	+	green	-	pink	+	-
Pseudomonas mohnii-moorei	AA30-04	100	-	+	+	-	-	-		+	-	denit	+	+	+	+	-	-	-	wa	+	pink	green	+c	pink	+	+
Pseudomonas monteilii	AArt-13	100	+	+	+	w+	-	-	-	+	-	-	-		+	w+	-	-	-	-	+	pink	green	-	pink	+	+
Pseudomonas mosselii	AArt-10	99	-	w+	+	+	-	-	-	+	-	denit	w+		+	-	-	-	-	a	+	+	green	-	purple	+	+
Pseudomonas novum	AA30-08	95.4	-	+	+	-	-	-		+	+	denit	+	+	+	+	+	-	-	b	+	pink	green	+	pink	+	+
Pseudomonas novum	AE44-04	94.8	-	-	+	W+	-	-	-	+	-	-	+		+	-	w+	-	-	wa	+	+	green	-	purple	+	-
Pseudomonas parafulva	ALAm-09	99.9	-	+	-	w+	-	-	-	+	-	-	-	-	+	+	-	w+	-	a	+	+	green	-	pink	+	-
Pseudomonas peli	ABI-05	99.4	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-
Pseudomonas peli	AEM-11	99.4	-	-	-	+	-	-	-	W+	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	+	-
Pseudomonas peli	AEM-13	99.6	-	-	-	+	-	-	+	W+	-	-	-		-	-	-	-	-	-	-	+	-	-	-	-	-
Pseudomonas plecoglossicida	AH-14	99.6	w+	+	+	-	-	-		+	-	-	-	+	-	-	-	-	+	-	+	pink	green	-	wpink	+	+
Pseudomonas pseudoalcaligenes	AH-13	97.5	+	+	+	+	-	-		+	-	+	-	+	+	-	-	+	+	b	+	+	green	-	purple	+	+
Pseudoxanthomonas mexicana	AEM-20	100	-	w+	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	a	-	w+	-	-	-	-	-
Xanthomonas vasicola	AArt-04	99.2	-	+	-	+	-	-	-	+	-	-	w+		+	-	-	+	+	-	+	orange	-	-	-	-	-