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Data article

Data in support of the comparative genome analysis of *Lysinibacillus* B1-CDA, a bacterium that accumulates arsenics



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ABSTRACT

This study is a part of our long term project on bioremediation of toxic metals and other pollutants for protection of human health and the environment from severe contamination. The information and results presented in this data article are based on both *in vitro* and *in silico* experiments. *in vitro* experiments were used to investigate the presence of arsenic responsive genes in a bacterial strain B1-CDA that is highly resistant to arsenics. However, *in silico* studies were used to annotate the function of the metal responsive genes. By using this combined study consisting of *in vitro* and *in silico* experiments we have identified and characterized specific genes from B1-CDA that can be used as a potential tool for removal of arsenics as well as other heavy metals from the contaminated environment.

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Subject area More specific sub- ject area	Biology Molecular biology, Microbiology. Studies of arsenic responsive genes as well as other metal responsive genes in bacteria
Type of data	Tables and figure
How data was acquired	The data was derived by NGS as a raw data then <i>de novo</i> assembly and gene annotation was performed
Data format	Analyzed
Experimental	Bacterial isolate Lysinibacillus sphaericus B1-CDA was cultured in the pre-
factors	sence of 100 mM arsenate and then DNA was isolated from these cells
Experimental	Genome sequencing and annotation of metal responsive genes in L. sphaer-
features	icus B1-CDA
Data source location	Bacterial sample was collected from a highly arsenic-contaminated culti- vated land located in the south-west region of Bangladesh. DNA analysis was performed at the University of Skövde, Sweden and NGS and <i>de novo</i> assembly at Otogenetics Corporation in Norcross, USA
Data accessibility	The genome information is available in EMBL as follows: [GenBank accession number LJYY01000000, http://www.ncbi.nlm.nih.gov/nuccore/ LJYY00000000]

Specifications table

Value of the data

- Complete genome sequencing of a highly arsenic resistant bacteria L. sphaericus, strain B1-CDA.
- Annotation of bacterial genes involved in binding and transport of toxic metals such as arsenics.
- Data presented in this article can be used to remove toxic metals from the contaminated sources thus protecting human health and the environment.
- In a longer term these data can also contribute to socio-economic development of a society.

1. Data

The information and results presented in this data article are derived from the *in vitro* experiments for investigation of the arsenic responsive genes. We also provide *in silico* data on gene annotation that can be potentially useful for conducting microbial bioremediation of toxic metals.

2. Experimental design, materials and methods

Lysinibacillus sphaericus B1-CDA strain was collected from a highly arsenic-contaminated region located in the south-west region of Bangladesh. Previously, we have reported that the strain *L. sphaericus* B1-CDA is highly resistant to arsenic and it accumulates arsenic inside the cells [1]. Genomic DNA was extracted from this bacterium, using Master pureTM Gram positive DNA purification kit (Epicenter, USA). Genome sequencing of the strain was performed by the Otogenetics Corporation (GA, USA). After sequencing the genome was assembled by *de novo* assembly employing SOAPDenovo, version 2.04 [2].

The assembled genome sequence was annotated with Rapid Annotations using Subsystems Technology, RAST [3]. Functional annotation analysis was also carried out by the Blast2GO pipeline [4] using all translated protein coding sequences resulting from the GeneMark. An InterPro scan [5] was performed through the Blast2GO interface and the InterPro IDs were merged with the Blast-derived GO-annotation for obtaining the integrated annotation results. The GO annotation of all putative metal responsive genes was manually curated. The functional annotation carried out by the RAST and

Table 1
Genes involved in metal ion binding and metal ion transport in B1-CDA predicted by RAST and/or Blast2GO.

Seq. name	No. of nucleotide	Start	End	Function
Gene 7	597	5406	6002	Metal ion binding
Gene 33	1464	34,171	35,634	Metal ion binding
Gene 46	1977	45,923	47,899	Metal ion binding
Gene 77	768	79,288	80,055	Metal ion binding
Gene 117	1995	127,168	129,162	Metal ion binding
Gene 171	1125	184,513	185.637	Metal ion binding
Gene 177	1425	190,919	192,343	Metal ion binding
Gene 188	2004	204.045	206.048	Metal ion binding
Gene 223	876	242.015	242.890	Metal ion binding
Gene 226	1674	244.232	245,905	Metal ion binding
Gene 238	1233	254.866	256.098	Metal ion binding
Gene 310	1587	328,134	329,720	Metal ion binding
Gene 313	1131	331.292	332,422	Metal ion binding
Gene 353	936	369.982	370.917	Metal ion binding
Gene 366	921	381.327	382,247	Metal ion binding
Gene 507	849	521.560	522,408	Metal ion binding
Gene 541	987	552.963	553,949	Metal ion binding
Gene 576	1110	596.085	597.194	Metal ion binding
Gene 578	918	598,123	599.040	Metal ion binding
Gene 600	741	615.128	615,868	Metal ion binding
Gene 603	1716	617.978	619.693	Metal ion binding
Gene 637	1164	651.099	652,262	Metal ion binding
Gene 765	1506	798,894	800.399	Metal ion binding
Gene 835	1047	884.978	886.024	Metal ion binding
Gene 845	1173	896.350	897.522	Metal ion binding
Gene 866	639	913 115	913 753	Metal ion binding
Gene 877	552	926.277	926.828	Metal ion binding
Gene 885	1113	935.597	936,709	Metal ion binding
Gene 953	1359	1.012.868	1.014.226	Metal ion binding
Gene 1010	669	1.072.202	1.072.870	Metal ion binding
Gene 1011	885	1.072.873	1.073.757	Metal ion binding
Gene 1014	1143	1.076.516	1.077.658	Metal ion binding
Gene 1039	774	1.105.712	1,106,485	Metal ion binding
Gene 1109	3435	1.174.450	1.177.884	Metal ion binding
Gene 1147	1668	1.212.657	1.214.324	Metal ion binding
Gene 1185	1185	1.255.829	1.257.013	Metal ion binding
Gene 1206	1740	1.277.562	1.279.301	Metal ion binding
Gene 1218	2067	1.294.077	1,296,143	Metal ion binding
Gene 1244	795	1.319.141	1.319.935	Metal ion binding
Gene 1271	3510	1.348.576	1.352.085	Metal ion binding
Gene 1294	2511	1,372,937	1,375,447	Metal ion binding
Gene 1322	2364	1,399,790	1,402,153	Metal ion binding
Gene 1389	204	1,481,600	1,481,803	Metal ion binding
Gene 1397	1002	1,491,472	1,492,473	Metal ion binding
Gene 1408	3249	1,500,339	1.503.587	Metal ion binding
Gene 1426	873	1.523,169	1.524.041	Metal ion binding
Gene 1432	1308	1.534.294	1.535.601	Metal ion binding
Gene 1467	765	1,563,504	1,564,268	Metal ion binding
Gene 1485	2079	1,582,041	1,584,119	Metal ion binding
Gene 1488	546	1,586,661	1,587,206	Metal ion binding
Gene 1536	1146	1,627,858	1,629,003	Metal ion binding
Gene 1564	1668	1,656,799	1,658,466	Metal ion binding
Gene 1571	1272	1,667,080	1,668,351	Metal ion binding
Gene 1572	1302	1,668.348	1,669.649	Metal ion binding
Gene 1580	1560	1,676,269	1,677,828	Metal ion binding
Gene 1612	1269	1,708,512	1,709,780	Metal ion binding
Gene 1667	1995	1,762,661	1,764,655	Metal ion binding
Gene 1684	558	1,776,672	1,777,229	Metal ion binding
Gene 1799	906	1,887,495	1,888,400	Metal ion binding

Table 1 (continued)

Gene 1874 417 1.959,673 1.960,089 Metal ion binc Gene 1889 507 1.974,321 1.974,827 Metal ion binc Gene 1925 1263 2.011,440 2.012,702 Metal ion binc Gene 2028 1203 2.120,007 2.121,209 Metal ion binc Gene 2032 615 2.173,172 2.173,786 Metal ion binc Gene 2137 1212 2.268,158 2.269,369 Metal ion binc Gene 223 1161 2.313,715 2.314,875 Metal ion binc Gene 2240 504 2.494,701 2.495,204 Metal ion binc Gene 247 237 2.515,822 2.516,058 Metal ion binc Gene 2464 984 2.622,804 2.633,787 Metal ion binc Gene 2355 1917 2.628,954 2.630,703 Metal ion binc Gene 3035 459 3.008,209 3.008,667 Metal ion binc Gene 3035 459 3.008,209 3.008,667 Metal ion binc Gene 3035 459<	eq. name	No. of nucleotide	Start	End	Function
Gene 1889 507 1,974,321 1,974,827 Metal ion bins Gene 1905 837 1,986,794 1987,630 Metal ion bins Gene 1905 1263 2,011,440 2,012,702 Metal ion bins Gene 2082 615 2,173,172 2,173,786 Metal ion bins Gene 217 1212 2,268,158 2,269,369 Metal ion bins Gene 227 1713 2,316,637 2,318,349 Metal ion bins Gene 2245 504 2,494,701 2,495,204 Metal ion bins Gene 2450 504 2,494,701 2,495,204 Metal ion bins Gene 2457 504 2,628,954 2,630,870 Metal ion bins Gene 2635 1917 2,628,954 2,630,870 Metal ion bins Gene 2635 1917 2,628,954 2,630,870 Metal ion bins Gene 3036 366 3,008,700 3,009,065 Metal ion bins Gene 3036 366 3,008,700 3,009,065 Metal ion bins Gene 3230 1746<	Gene 1874	417	1,959,673	1,960,089	Metal ion binding
Gene 1905 837 1,986,794 1,987,630 Metal ion bins Gene 1925 1263 2,011,440 2,012,702 Metal ion bins Gene 2028 1203 2,120,007 2,121,209 Metal ion bins Gene 2028 615 2,173,172 2,173,786 Metal ion bins Gene 2132 1428 2,225,179 2,226,606 Metal ion bins Gene 2237 1161 2,313,715 2,314,8475 Metal ion bins Gene 2450 504 2,494,701 2,495,204 Metal ion bins Gene 2451 917 2,628,954 2,630,870 Metal ion bins Gene 2635 1917 2,628,954 2,630,870 Metal ion bins Gene 2635 917 2,628,954 2,630,870 Metal ion bins Gene 3035 459 3,008,209 3,008,667 Metal ion bins Gene 3036 366 3,008,700 3,009,065 Metal ion bins Gene 3250 5911 3,187,349 3,187,399 Metal ion bins Gene 3250	Gene 1889	507	1,974,321	1,974,827	Metal ion binding
Gene 1925 1263 2,011,440 2,012,702 Metal ion bins Gene 2082 1615 2,173,172 2,173,786 Metal ion bins Gene 2132 1428 2,225,179 2,226,606 Metal ion bins Gene 2177 1212 2,268,158 2,269,309 Metal ion bins Gene 2273 1161 2,313,715 2,314,875 Metal ion bins Gene 2273 1161 2,415,637 2,318,349 Metal ion bins Gene 2450 504 2,494,701 2,495,204 Metal ion bins Gene 2635 1917 2,628,954 2,630,870 Metal ion bins Gene 2635 1917 2,628,954 2,630,870 Metal ion bins Gene 2307 2,706 2,987,030 2,989,735 Metal ion bins Gene 3303 459 3,008,607 3,009,065 Metal ion bins Gene 3226 591 3,187,349 3,187,399 Metal ion bins Gene 3252 1017 3,188,465 3,189,481 Metal ion bins Gene 3233	Gene 1905	837	1,986,794	1,987,630	Metal ion binding
Gene 2028 1203 2,120,007 2,121,209 Metal ion binc Gene 2032 615 2,173,172 2,173,786 Metal ion binc Gene 2132 1428 2,225,179 2,226,606 Metal ion binc Gene 2232 1161 2,313,715 2,314,875 Metal ion binc Gene 2247 1713 2,316,637 2,318,349 Metal ion binc Gene 2450 504 2,494,701 2,495,9204 Metal ion binc Gene 2451 984 2,622,804 2,633,870 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 3035 459 3,008,209 3,008,667 Metal ion binc Gene 3035 459 3,008,209 3,009,665 Metal ion binc Gene 3250 591 3,187,349 3,187,939 Metal ion binc Gene 3250 591 3,187,349 3,187,939 Metal ion binc Gene 3250 591 3,237,637 Metal ion binc Gene 3233 1773 3,258,173 <t< td=""><td>Gene 1925</td><td>1263</td><td>2,011,440</td><td>2,012,702</td><td>Metal ion binding</td></t<>	Gene 1925	1263	2,011,440	2,012,702	Metal ion binding
Gene 2082 615 2,173,172 2,173,786 Metal ion binc Gene 2132 1428 2,225,179 2,226,0369 Metal ion binc Gene 2177 1212 2,268,158 2,269,369 Metal ion binc Gene 2227 1713 2,316,637 2,318,349 Metal ion binc Gene 2247 237 2,515,822 2,516,058 Metal ion binc Gene 2647 237 2,628,954 2,630,870 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 2635 1917 2,628,954 2,849,792 Metal ion binc Gene 3007 2706 2,987,030 2,989,735 Metal ion binc Gene 3035 459 3,008,700 3,009,0055 Metal ion binc Gene 3252 1017 3,188,474 3,187,939 Metal ion binc Gene 3252 1017 3,188,473 3,259,345 Metal ion binc Gene 3252	Gene 2028	1203	2,120,007	2,121,209	Metal ion binding
Gene 2132 1428 2.225,179 2.226,060 Metal ion binc Gene 2177 1212 2.268,158 2.269,369 Metal ion binc Gene 2223 1161 2.313,715 2.314,875 Metal ion binc Gene 2240 504 2.494,701 2.495,204 Metal ion binc Gene 2450 504 2.649,701 2.652,854 2.630,870 Metal ion binc Gene 2635 1917 2.628,954 2.630,870 Metal ion binc Gene 2635 1917 2.628,954 2.630,870 Metal ion binc Gene 3035 459 3.008,209 3.008,667 Metal ion binc Gene 3036 366 3.008,700 3.099,065 Metal ion binc Gene 3250 591 3.187,349 3.187,939 Metal ion binc Gene 3250 591 3.187,349 3.187,939 Metal ion binc Gene 3230 1746 3.235,892 3.237,637 Metal ion binc Gene 3331 1410 3.268,181 3.269,590 Metal ion binc	Gene 2082	615	2,173,172	2,173,786	Metal ion binding
Gene 2177 1212 2.268,158 2.269,369 Metal ion binc Gene 2223 1161 2.313,715 2.318,349 Metal ion binc Gene 2450 504 2.416,637 2.318,349 Metal ion binc Gene 2470 504 2.494,701 2.495,204 Metal ion binc Gene 2471 237 2.515,822 2.516,058 Metal ion binc Gene 2635 1917 2.622,804 2.630,870 Metal ion binc Gene 2635 969 2.848,824 2.849,792 Metal ion binc Gene 3037 2706 2.987,030 2.989,735 Metal ion binc Gene 3036 366 3.008,209 3.008,667 Metal ion binc Gene 3236 366 3.008,209 3.008,667 Metal ion binc Gene 3236 591 3.187,349 3.187,939 Metal ion binc Gene 3236 1077 3.188,465 3.189,481 Metal ion binc Gene 3230 1746 3.235,892 3.237,763 Metal ion binc Gene 3337 1	Gene 2132	1428	2,225,179	2,226,606	Metal ion binding
Gene 2223 1161 2,315,715 2,314,875 Metal ion binc Gene 2237 1713 2,316,637 2,318,349 Metal ion binc Gene 2430 504 2,494,701 2,495,204 Metal ion binc Gene 2643 984 2,622,804 2,630,870 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 3037 2706 2,987,030 2,989,735 Metal ion binc Gene 3035 459 3,008,209 3,008,667 Metal ion binc Gene 3036 366 3,008,700 3,009,065 Metal ion binc Gene 3250 591 3,187,349 3,187,339 Metal ion binc Gene 3250 591 3,187,349 3,182,481 Metal ion binc Gene 3230 1746 3,235,822 3,237,637 Metal ion binc Gene 3331 1410 3,268,113 3,269,590 Metal ion binc Gene 3331 1410 3,268,101 3,327,637 Metal ion binc Gene 3437	Gene 2177	1212	2,268,158	2,269,369	Metal ion binding
Gene 2227 1713 2,316,637 2,318,349 Metal ion binc Gene 2450 504 2,494,701 2,495,204 Metal ion binc Gene 2451 504 2,615,822 2,516,058 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 2635 1917 2,628,954 2,640,870 Metal ion binc Gene 3037 2706 2,987,030 2,989,735 Metal ion binc Gene 3036 366 3,008,209 3,008,667 Metal ion binc Gene 3036 366 3,008,209 3,008,667 Metal ion binc Gene 325 591 3,187,349 3,187,339 Metal ion binc Gene 325 1017 3,188,465 3,189,481 Metal ion binc Gene 3230 1746 3,231,270 3,232,1737 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,000 3,277,677 Metal ion binc Gene 3437	Gene 2223	1161	2,313,715	2,314,875	Metal ion binding
Gene 2450 504 2,494,701 2,495,204 Metal ion binc Gene 2477 2,377 2,515,822 2,516,058 Metal ion binc Gene 2635 1917 2,622,804 2,623,787 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 2839 969 2,848,824 2,849,792 Metal ion binc Gene 3007 2,706 2,987,030 2,989,735 Metal ion binc Gene 3035 459 3,008,209 3,008,607 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3225 1017 3,187,349 3,187,939 Metal ion binc Gene 3230 1746 3,2258,92 3,237,637 Metal ion binc Gene 3331 1410 3,268,181 3,269,930 Metal ion binc Gene 3331 1410 3,268,181 3,269,9345 Metal ion binc Gene 3437 414 3,376,670 3,311,732 Metal ion binc Gene 3442	Gene 2227	1713	2,316,637	2,318,349	Metal ion binding
Gene 2477 237 2,515,822 2,516,058 Metal ion binc Gene 2624 984 2,622,804 2,633,870 Metal ion binc Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 3007 2706 2,989,735 Metal ion binc Gene 3035 459 3,008,209 3,008,667 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3220 591 3,187,349 3,187,939 Metal ion binc Gene 3252 1017 3,188,465 3,189,481 Metal ion binc Gene 326 099 3,231,270 3,232,178 Metal ion binc Gene 3300 1746 3,235,892 3,237,637 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3337 1671 3,276,630 3,278,63 Metal ion binc Gene 3441 2154 3,379,	Gene 2450	504	2,494,701	2,495,204	Metal ion binding
Gene 2624 984 2.622,804 2.623,787 Metal ion binc Gene 2635 1917 2.628,954 2.630,870 Metal ion binc Gene 2859 969 2.848,824 2.849,792 Metal ion binc Gene 3007 2706 2.987,030 2.989,735 Metal ion binc Gene 3036 366 3.008,700 3.009,065 Metal ion binc Gene 3216 2607 3.159,474 3.162,080 Metal ion binc Gene 3250 591 3.187,449 3.187,039 Metal ion binc Gene 3226 1017 3.188,465 3.189,481 Metal ion binc Gene 3230 1746 3.235,892 3.237,637 Metal ion binc Gene 3331 1410 3.268,181 3.269,590 Metal ion binc Gene 3331 1410 3.266,301 3.277,970 Metal ion binc Gene 3437 414 3.376,600 3.376,473 Metal ion binc <td>Gene 2477</td> <td>237</td> <td>2,515,822</td> <td>2,516,058</td> <td>Metal ion binding</td>	Gene 2477	237	2,515,822	2,516,058	Metal ion binding
Gene 2635 1917 2,628,954 2,630,870 Metal ion binc Gene 2635 969 2,848,824 2,849,792 Metal ion binc Gene 3037 2706 2,987,030 2,989,735 Metal ion binc Gene 3035 459 3,008,209 3,008,667 Metal ion binc Gene 3036 366 3,008,700 3,009,065 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3220 591 3,187,349 3,187,939 Metal ion binc Gene 3260 909 3,231,270 3,232,173 Metal ion binc Gene 3230 1746 3,258,173 3,259,345 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3437 414 3,376,660 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3442	Gene 2624	984	2.622.804	2.623.787	Metal ion binding
Gene 2859 969 2.848,824 2,849,792 Metal ion binc Gene 3007 2706 2,987,030 2,989,735 Metal ion binc Gene 3036 366 3,008,700 3,009,065 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3225 591 3,187,349 3,187,939 Metal ion binc Gene 3226 909 3,231,270 3,232,178 Metal ion binc Gene 3203 1173 3,258,912 3,237,637 Metal ion binc Gene 3323 1173 3,258,173 3,259,345 Metal ion binc Gene 3333 1410 3,268,181 3,269,900 Metal ion binc Gene 3333 963 3,326,901 3,327,863 Metal ion binc Gene 3437 414 3,376,060 3,76,473 Metal ion binc Gene 3437 414 3,376,050 3,381,732 Metal ion binc	Gene 2635	1917	2.628,954	2.630.870	Metal ion binding
Gene 3007 2706 2,987,030 2,989,735 Metal ion binc Gene 3035 459 3,008,209 3,008,667 Metal ion binc Gene 3036 366 3,008,700 3,009,065 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3226 591 3,187,349 3,187,393 Metal ion binc Gene 3226 1017 3,188,465 3,189,481 Metal ion binc Gene 3236 909 3,231,270 3,232,178 Metal ion binc Gene 3330 1746 3,258,913 3,259,04 Metal ion binc Gene 3331 1410 3,268,181 3,269,050 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 347 414 3,376,601 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3468 1368 3,410,015 3,414.48 Metal ion binc Gene 3576 11	Gene 2859	969	2.848.824	2.849.792	Metal ion binding
Cene 3035 459 3,008,209 3,008,667 Metal ion binc Gene 3036 366 3,008,700 3,009,065 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3252 1017 3,188,465 3,189,481 Metal ion binc Gene 3252 1017 3,188,465 3,189,481 Metal ion binc Gene 3200 1746 3,235,892 3,237,637 Metal ion binc Gene 3300 1746 3,258,173 3,259,345 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,27,863 Metal ion binc Gene 3437 414 3,376,060 3,76,473 Metal ion binc Gene 3441 2154 3,379,579 3,881,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc <td>Gene 3007</td> <td>2706</td> <td>2,987,030</td> <td>2,989,735</td> <td>Metal ion binding</td>	Gene 3007	2706	2,987,030	2,989,735	Metal ion binding
Gene 3036 366 3,008,700 3,009,065 Metal ion binc Gene 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3250 591 3,187,349 3,187,939 Metal ion binc Gene 3252 1017 3,188,465 3,189,481 Metal ion binc Gene 3230 1746 3,235,892 3,237,637 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3337 1671 3,276,300 3,377,970 Metal ion binc Gene 3437 414 3,376,600 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3441 1592 3,381,729 3,383,420 Metal ion binc <	Gene 3035	459	3 008 209	3,008,667	Metal ion binding
Cane 3216 2607 3,159,474 3,162,080 Metal ion binc Gene 3250 591 3,187,349 3,187,939 Metal ion binc Gene 3252 1017 3,188,465 3,189,481 Metal ion binc Gene 3252 1017 3,182,465 3,189,481 Metal ion binc Gene 3206 909 3,231,270 3,232,178 Metal ion binc Gene 3300 1746 3,258,173 3,259,345 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3437 414 3,370,600 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3564 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 <	Jene 3036	366	3,008,200	3,009,065	Metal ion binding
Carle 210 2007 3,132,747 3,102,000 Metal ion binc Gene 3250 591 3,187,349 3,187,393 Metal ion binc Gene 3252 1017 3,188,465 3,189,481 Metal ion binc Gene 3206 909 3,231,270 3,232,178 Metal ion binc Gene 3300 1746 3,235,892 3,237,637 Metal ion binc Gene 3323 1173 3,258,173 3,259,345 Metal ion binc Gene 3331 1410 3,268,901 3,277,970 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3437 414 3,376,660 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3560 1206 3,604,978 3,607,592 Metal ion binc Gene 3560 <	Jene 3216	2607	3 159 474	3 162 080	Metal ion binding
Sche 220 371 3787-97 3787-97 3787-97 3787-97 3787-97 3787-97 3787-97 Metal ion binc Gene 3296 909 3,231,270 3,232,178 Metal ion binc Gene 3230 1746 3,235,892 3,237,637 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3337 1671 3,276,000 3,376,473 Metal ion binc Gene 3437 414 3,370,679 3,381,732 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3664 1227 3,602,057 3,603,283 Metal ion binc Gene 3654 1227 3,602,579 Metal ion binc Gene 3680 1006 106 Gene 3702	ane 3250	501	3 187 3/10	3 187 030	Metal ion binding
Gene 3292 1017 3,183,403 3,183,401 Metal 101 bink Gene 3296 909 3,231,270 3,232,178 Metal 10n bink Gene 3300 1746 3,258,892 3,237,637 Metal 10n bink Gene 3323 1173 3,268,181 3,269,590 Metal 10n bink Gene 3337 1671 3,276,300 3,277,970 Metal 10n bink Gene 3393 963 3,326,901 3,327,863 Metal 10n bink Gene 3437 414 3,376,060 3,376,473 Metal 10n bink Gene 3441 2154 3,379,579 3,381,732 Metal 10n bink Gene 3442 1692 3,381,729 3,383,420 Metal 10n bink Gene 3468 1368 3,410,115 3,411,482 Metal 10n bink Gene 3576 1104 3,514,691 3,515,794 Metal 10n bink Gene 3660 615 3,600,057 3,603,283 Metal 10n bink Gene 3702 1116 3,656,366 3,657,501 Metal 10n bink Gene 3712 <t< td=""><td>2000 2252</td><td>1017</td><td>2 100 /65</td><td>2 100 /01</td><td>Motal ion binding</td></t<>	2000 2252	1017	2 100 /65	2 100 /01	Motal ion binding
Gene 3200 1746 3,231,70 3,231,70 Metal ion bind Gene 3300 1746 3,236,892 3,237,637 Metal ion bind Gene 3323 1173 3,258,173 3,259,345 Metal ion bind Gene 3331 1410 3,268,181 3,226,9590 Metal ion bind Gene 3337 1671 3,276,000 3,277,970 Metal ion bind Gene 3437 414 3,376,660 3,376,473 Metal ion bind Gene 3441 2154 3,379,579 3,381,732 Metal ion bind Gene 3442 1692 3,381,729 3,383,420 Metal ion bind Gene 3468 1368 3,410,115 3,411,482 Metal ion bind Gene 3468 1368 3,610,517 3,603,283 Metal ion bind Gene 3576 1104 3,514,691 3,515,794 Metal ion bind Gene 3660 615 3,602,057 3,603,283 Metal ion bind Gene 3702 1116 3,656,386 3,657,501 Metal ion bind Gene 3712 <	2202 2010 2206	000	2 221 270	2 727 170	Motal ion binding
Gene 3500 146 3,253,692 5,253,657 Metal ion bind Gene 3323 1173 3,258,173 3,259,345 Metal ion bind Gene 3331 1410 3,268,181 3,269,590 Metal ion bind Gene 3337 1671 3,276,300 3,277,970 Metal ion bind Gene 3437 414 3,376,060 3,376,473 Metal ion bind Gene 3441 2154 3,379,579 3,381,732 Metal ion bind Gene 3441 2154 3,376,060 3,376,473 Metal ion bind Gene 3441 2154 3,379,579 3,381,732 Metal ion bind Gene 3468 1368 3,410,115 3,411,482 Metal ion bind Gene 3566 104 3,514,691 3,515,794 Metal ion bind Gene 3560 1615 3,602,057 3,603,283 Metal ion bind Gene 3602 1716 3,656,386 3,657,501 Metal ion bind <	Jelle 3230	1746	2,221,270	3,232,170	Motal ion binding
Gene 3323 1173 3,253,173 3,253,345 Metal ion binc Gene 3331 1410 3,268,181 3,269,590 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3337 963 3,326,901 3,327,863 Metal ion binc Gene 3437 414 3,376,060 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3442 1692 3,311,15 3,411,482 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3564 1227 3,602,057 3,603,283 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,409 3,668,408 Metal ion binc <t< td=""><td>Jelle 2200</td><td>1172</td><td>3,233,692</td><td>3,237,037</td><td>Matal ion binding</td></t<>	Jelle 2200	1172	3,233,692	3,237,037	Matal ion binding
Gene 3337 1410 3,266,181 3,269,390 Metal ion binc Gene 3337 1671 3,276,300 3,277,970 Metal ion binc Gene 3337 1671 3,326,901 3,327,863 Metal ion binc Gene 3437 414 3,376,060 3,376,473 Metal ion binc Gene 3441 2154 3,376,079 3,81,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3660 615 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,604,978 3,607,592 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,429 3,669,408 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc	Jelle 3323	11/3	3,238,173	3,239,343	Metal ion binding
Gene 3337 1671 5,276,500 3,27,970 Intel 101 binc Gene 3393 963 3,326,901 3,327,863 Metal ion binc Gene 3393 963 3,326,901 3,327,863 Metal ion binc Gene 3441 2154 3,376,679 3,381,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3590 1716 3,530,171 3,531,886 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,429 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc <t< td=""><td>Jelle 3331</td><td>1410</td><td>3,208,181</td><td>3,269,590</td><td>Metal ion binding</td></t<>	Jelle 3331	1410	3,208,181	3,269,590	Metal ion binding
Jene 3393 963 3,26,901 3,27,863 Metal ion bind Gene 3437 414 3,376,060 3,376,473 Metal ion bind Gene 3441 2154 3,379,579 3,381,732 Metal ion bind Gene 3442 1692 3,381,729 3,383,420 Metal ion bind Gene 3468 1368 3,410,115 3,411,482 Metal ion bind Gene 3576 1104 3,514,691 3,515,794 Metal ion bind Gene 3590 1716 3,530,171 3,531,886 Metal ion bind Gene 3654 1227 3,602,057 3,603,283 Metal ion bind Gene 3660 615 3,606,978 3,607,592 Metal ion bind Gene 3702 1116 3,656,386 3,657,501 Metal ion bind Gene 3711 957 3,667,171 3,668,429 3,669,408 Metal ion bind Gene 3738 1932 3,693,364 3,695,295 Metal ion bind Gene 3797 594 3,750,078 3,750,671 Metal ion bind G	Jene 3337	1671	3,276,300	3,277,970	Metal ion binding
Gene 3437 414 3,376,040 3,376,473 Metal ion binc Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3468 1368 3,410,115 3,515,794 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 378 1932 3,610,517 3,811,497 Metal ion binc Gene 378 <td< td=""><td>Jene 3393</td><td>963</td><td>3,326,901</td><td>3,327,863</td><td>Metal ion binding</td></td<>	Jene 3393	963	3,326,901	3,327,863	Metal ion binding
Gene 3441 2154 3,379,579 3,381,732 Metal ion binc Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3590 1716 3,530,171 3,531,886 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,429 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,862,117 3,863,031 Metal ion binc <t< td=""><td>Jene 3437</td><td>414</td><td>3,376,060</td><td>3,3/6,4/3</td><td>Metal ion binding</td></t<>	Jene 3437	414	3,376,060	3,3/6,4/3	Metal ion binding
Gene 3442 1692 3,381,729 3,383,420 Metal ion binc Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3576 1227 3,602,057 3,603,283 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3889 1146 3,839,858 3,841,003 Metal ion binc Gene 3908 <t< td=""><td>Jene 3441</td><td>2154</td><td>3,3/9,5/9</td><td>3,381,732</td><td>Metal ion binding</td></t<>	Jene 3441	2154	3,3/9,5/9	3,381,732	Metal ion binding
Gene 3468 1368 3,410,115 3,411,482 Metal ion binc Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3590 1716 3,530,171 3,531,886 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 3908	Gene 3442	1692	3,381,729	3,383,420	Metal ion binding
Gene 3576 1104 3,514,691 3,515,794 Metal ion binc Gene 3590 1716 3,530,171 3,531,886 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,655,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 4020 570 3,969,387 3,969,956 Metal ion binc Gene 4030 2121 3,978,	Gene 3468	1368	3,410,115	3,411,482	Metal ion binding
Gene 3590 1716 3,530,171 3,531,886 Metal ion binc Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,408 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 3904 573 3,917,646 3,918,218 Metal ion binc Gene 4020 570 3,968,327 3,969,956 Metal ion binc Gene 4038 17	Gene 3576	1104	3,514,691	3,515,794	Metal ion binding
Gene 3654 1227 3,602,057 3,603,283 Metal ion binc Gene 3660 615 3,606,978 3,607,592 Metal ion binc Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 377 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 3964 573 3,917,646 3,918,218 Metal ion binc Gene 4020 570 3,968,387 3,980,668 Metal ion binc Gene 4038 1731 3,986,132 3,987,862 Metal ion binc Gene 4038 163	Jene 3590	1716	3,530,171	3,531,886	Metal ion binding
Gene 3660 615 3,606,978 3,607,592 Metal ion bind Gene 3680 1206 3,634,474 3,635,679 Metal ion bind Gene 3702 1116 3,656,386 3,657,501 Metal ion bind Gene 3711 957 3,667,171 3,668,127 Metal ion bind Gene 3712 960 3,668,449 3,669,408 Metal ion bind Gene 3738 1932 3,693,364 3,695,295 Metal ion bind Gene 3777 594 3,750,078 3,750,671 Metal ion bind Gene 3857 981 3,810,517 3,811,497 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3904 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,357 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4070 90	Jene 3654	1227	3,602,057	3,603,283	Metal ion binding
Gene 3680 1206 3,634,474 3,635,679 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3988 1146 3,839,858 3,841,003 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 3964 573 3,917,646 3,918,218 Metal ion binc Gene 4020 570 3,969,387 3,969,956 Metal ion binc Gene 4030 2121 3,978,548 3,980,668 Metal ion binc Gene 4038 1	Jene 3660	615	3,606,978	3,607,592	Metal ion binding
Gene 3702 1116 3,656,386 3,657,501 Metal ion binc Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3899 1146 3,839,858 3,841,003 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 3904 573 3,917,646 3,918,218 Metal ion binc Gene 4020 570 3,969,387 3,969,956 Metal ion binc Gene 4030 2121 3,978,548 3,980,668 Metal ion binc Gene 4038 1731 3,986,132 3,987,862 Metal ion binc	Gene 3680	1206	3,634,474	3,635,679	Metal ion binding
Gene 3711 957 3,667,171 3,668,127 Metal ion binc Gene 3712 960 3,668,449 3,669,408 Metal ion binc Gene 3738 1932 3,693,364 3,695,295 Metal ion binc Gene 3797 594 3,750,078 3,750,671 Metal ion binc Gene 3857 981 3,810,517 3,811,497 Metal ion binc Gene 3899 1146 3,839,858 3,841,003 Metal ion binc Gene 3908 915 3,862,117 3,863,031 Metal ion binc Gene 3904 573 3,917,646 3,918,218 Metal ion binc Gene 4020 570 3,969,387 3,969,956 Metal ion binc Gene 4030 2121 3,978,548 3,980,668 Metal ion binc Gene 4038 1731 3,986,132 3,987,862 Metal ion binc Gene 4058 969 4,006,280 4,007,248 Metal ion binc Gene 4070 906 <td< td=""><td>Gene 3702</td><td>1116</td><td>3,656,386</td><td>3,657,501</td><td>Metal ion binding</td></td<>	Gene 3702	1116	3,656,386	3,657,501	Metal ion binding
Gene 3712 960 3,668,449 3,669,408 Metal ion bind Gene 3738 1932 3,693,364 3,695,295 Metal ion bind Gene 3737 594 3,750,078 3,750,671 Metal ion bind Gene 3797 594 3,750,078 3,750,671 Metal ion bind Gene 3857 981 3,810,517 3,811,497 Metal ion bind Gene 3859 1146 3,839,858 3,841,003 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3904 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4070 906 4,002,2891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind Gene 4218 1	Gene 3711	957	3,667,171	3,668,127	Metal ion binding
Gene 3738 1932 3,693,364 3,695,295 Metal ion bind Gene 3797 594 3,750,078 3,750,671 Metal ion bind Gene 3857 981 3,810,517 3,811,497 Metal ion bind Gene 3889 1146 3,839,858 3,841,003 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3964 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 3712	960	3,668,449	3,669,408	Metal ion binding
Gene 3797 594 3,750,078 3,750,671 Metal ion bind Gene 3857 981 3,810,517 3,811,497 Metal ion bind Gene 3889 1146 3,839,858 3,841,003 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3964 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 3738	1932	3,693,364	3,695,295	Metal ion binding
Gene 3857 981 3,810,517 3,811,497 Metal ion bind Gene 3889 1146 3,839,858 3,841,003 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3904 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind Gene 4218 1625 4160,104 4161,769 Metal ion bind	Gene 3797	594	3,750,078	3,750,671	Metal ion binding
Gene 3889 1146 3,839,858 3,841,003 Metal ion bind Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3964 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 3857	981	3,810,517	3,811,497	Metal ion binding
Gene 3908 915 3,862,117 3,863,031 Metal ion bind Gene 3964 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 3889	1146	3,839,858	3,841,003	Metal ion binding
Gene 3964 573 3,917,646 3,918,218 Metal ion bind Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 3908	915	3,862,117	3,863,031	Metal ion binding
Gene 4020 570 3,969,387 3,969,956 Metal ion bind Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind Gene 4218 1625 4160144 41617,769 Metal ion bind	Gene 3964	573	3,917,646	3,918,218	Metal ion binding
Gene 4030 2121 3,978,548 3,980,668 Metal ion bind Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 4020	570	3,969,387	3,969,956	Metal ion binding
Gene 4038 1731 3,986,132 3,987,862 Metal ion bind Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind Gene 4218 1625 4160,124 4161,769 Metal ion bind	Gene 4030	2121	3,978,548	3,980,668	Metal ion binding
Gene 4058 969 4,006,280 4,007,248 Metal ion bind Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind Gene 4218 1675 4150,114 4157,750 Metal ion bind	Gene 4038	1731	3,986,132	3,987,862	Metal ion binding
Gene 4070 906 4,023,891 4,024,796 Metal ion bind Gene 4215 1071 4,157,550 4,158,620 Metal ion bind Gene 4218 1625 4161,769 Metal ion bind	Gene 4058	969	4,006,280	4,007,248	Metal ion binding
Gene 4215 1071 4,157,550 4,158,620 Metal ion bind	Gene 4070	906	4,023,891	4,024,796	Metal ion binding
Cone 4019 1625 410104 4101700 Michildren http://	Gene 4215	1071	4,157,550	4,158,620	Metal ion binding
Jene 4210 1030 4,100,134 4,101,768 Metal 100 bind	Gene 4218	1635	4,160,134	4,161,768	Metal ion binding
Gene 4272 1107 4,218,954 4,220,060 Metal ion bind	Gene 4272	1107	4,218,954	4,220,060	Metal ion binding
Gene 4295 1380 4.241.915 4.243.294 Metal ion binc	Gene 4295	1380	4,241.915	4,243.294	Metal ion binding
Gene 4298 2361 4.245.236 4.247.596 Metal ion bind	Gene 4298	2361	4.245.236	4.247.596	Metal ion binding
Gene 4306 2124 4.254 484 4.256 607 Metal ion tran	Gene 4306	2124	4,254 484	4.256 607	Metal ion transpor
Cene 4346 1083 4 294 106 4 295 188 Metal ion bir	Gene 4346	1083	4 294 106	4 295 188	Metal ion hinding
Cene 4357 1386 4 307 321 4 308 706 Metal ion bin	Cene 4357	1386	4 307 321	4 308 706	Metal ion hinding
Cane 4400 729 4 354 264 4 354 902 Metal ion bind	Cene 4400	729	4 354 264	4 354 992	Metal ion hinding
Conc 4454 957 4 410 502 4 411 450 Matching bins	Jene 4454	957	4,334,204	4,554,552	Metal ion binding

Table 1 (continued)

Seq. name	No. of nucleotide	Start	End	Function
Gene 4490	1377	4,445,126	4,446,502	Metal ion binding
Gene 4495	1461	4,450,541	4,452,001	Metal ion binding
Gene 4542	654	4,490,448	4,491,101	Metal ion binding

Table 2

Genes involved in metalloendopeptidase, metalloexopeptidase, metallopeptidase, metallochaperone and metallocarboxypeptidase protein predicted by RAST and Blast2GO are present in B1-CDA.

Seq. name	No. of nucleotide	Start	End	Function
Gene 75	2028	76,022	78,049	Metalloendopeptidase activity
Gene 90	1065	92,201	93,265	Metalloexopeptidase activity
Gene 95	1017	96,135	97,151	Metalloendopeptidase activity
Gene 248	756	266,333	267,088	Metalloexopeptidase activity
Gene 435	675	456,865	457,539	Metallopeptidase activity
Gene 597	1509	612,142	613,650	Metalloexopeptidase activity
Gene 890	1230	940,132	941,361	Metallopeptidase activity
Gene 1251	1818	1,324,367	1,326,184	Metalloendopeptidase activity
Gene 1537	1263	1,629,050	1,630,312	Metalloendopeptidase activity
Gene 1553	1224	1,648,658	1,649,881	Metalloendopeptidase activity
Gene 1825	1287	1,914,934	1,916,220	Metalloendopeptidase activity
Gene 2009	1497	2,101,832	2,103,328	Metallocarboxypeptidase activity
Gene 2062	1815	2,151,841	2,153,655	Metalloendopeptidase activity
Gene 2087	1233	2,180,574	2,181,806	Metallopeptidase activity
Gene 2153	732	2,244,087	2,244,818	Metallopeptidase activity
Gene 2442	555	2,489,739	2,490,293	Metallopeptidase activity
Gene 2665	630	2,656,743	2,657,372	Metallochaperone activity
Gene 3223	1089	3,166,498	3,167,586	Metalloexopeptidase activity
Gene 3434	1116	3,372,197	3,373,312	Metallopeptidase activity
Gene 3478	1062	3,416,770	3,417,831	Metalloexopeptidase activity
Gene 3587	927	3,526,686	3,527,612	Metalloexopeptidase activity
Gene 3609	1269	3,548,363	3,549,631	Metallopeptidase activity
Gene 3703	1089	3,657,553	3,658,641	Metalloexopeptidase activity
Gene 3874	612	3,828,598	3,829,209	Metalloendopeptidase activity
Gene 3973	1017	3,924,998	3,926,014	Metalloendopeptidase activity
Gene 4031	474	3,980,677	3,981,150	Metalloendopeptidase activity
Gene 4110	1212	4,067,537	4,068,748	Metallopeptidase activity
Gene 4255	1698	4,199,161	4,200,858	Metalloendopeptidase activity
Gene 4381	1461	4,331,031	4,332,491	Metallopeptidase activity
Gene 4433	1191	4,384,176	4,385,366	Metallocarboxypeptidase activity

Blast2GO indicates that B1-CDA contains many genes which are responsive to specific metal ions like arsenic, cobalt, copper, iron, nickel, potassium, manganese and zinc. Prediction by RAST and Blast2GO (Table 1) revealed that the B1-CDA genome contains additionally a total of 123 proteins involved in binding and transport of metal ions. Further, B1-CDA contains many other proteins (approximately 30) that catalyze binding and transport of the metal ions such as metalloendopeptidase, metalloex-opeptidase, metallocarboxypeptidase and metallochaperone (Table 2).

In this article, we have studied the presence of arsenic resistance genes in this bacterium by using PCR amplification. The strain B1-CDA was found to harbor *acr3*, *arsR*, *arsB* and *arsC* arsenic marker genes (Fig. 1). The *arsC* gene codes for the enzyme arsenate reductase, which is responsible for the biotransformation of arsenate [As(V)] to arsenite [As(III)] prior to efflux. ArsB, an integral membrane protein that pumps arsenite out of the cell, is often associated with an ATPase subunit, arsA [6]. It is hypothesized that the *arsB/acr3* genes are the primary determinants in arsenite resistance [6]. The results of these studies could be used to cope with arsenic toxicity by removing it from the contaminated source or converting it to a less toxic harmless compound.



Fig. 1. Molecular analysis of arsenic responsive genes of B1-CDA and gel electrophoresis: (A) PCR amplification of *acr3* gene. L represents 50 bp DNA marker, whereas lane 1 and 2 are the amplified fragments of *acr3* gene in two replicates. (B) PCR amplification of *arsR* gene. L represents 2-log DNA marker, whereas lane 1, 2 and 3 are the amplified fragments of *arsR* gene in three replicates. (C) PCR amplification of *arsB* gene. L represents 2-log DNA marker, whereas 2-log DNA marker, whereas lane 1, 2, 3, 4, 5 and 6 are the amplified fragments of *arsB* gene in six replicates and (D) PCR amplification of *arsC* gene. L represents 2-log DNA marker, whereas lane 1, 2 and 3 are the amplified fragments of *arsB* gene in six replicates and (D) PCR amplification of *arsC* gene. L represents 2-log DNA marker, whereas lane 1, 2 and 3 are the amplified fragments of *arsB* gene in six replicates and (D) PCR amplification.

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