

-Supplementary Material-

***Acinetobacter nematophilus* sp. nov., *Alcaligenes nematophilus* sp. nov.,
Enterobacter nematophilus sp. nov., and *Kaistia nematophila* sp. nov.,
isolated from soil-borne nematodes and proposal for the elevation of
Alcaligenes faecalis subsp. *faecalis*, *Alcaligenes faecalis* subsp.
parafaecalis, and *Alcaligenes faecalis* subsp. *phenolicus* to the species level**

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-Supplementary Figures

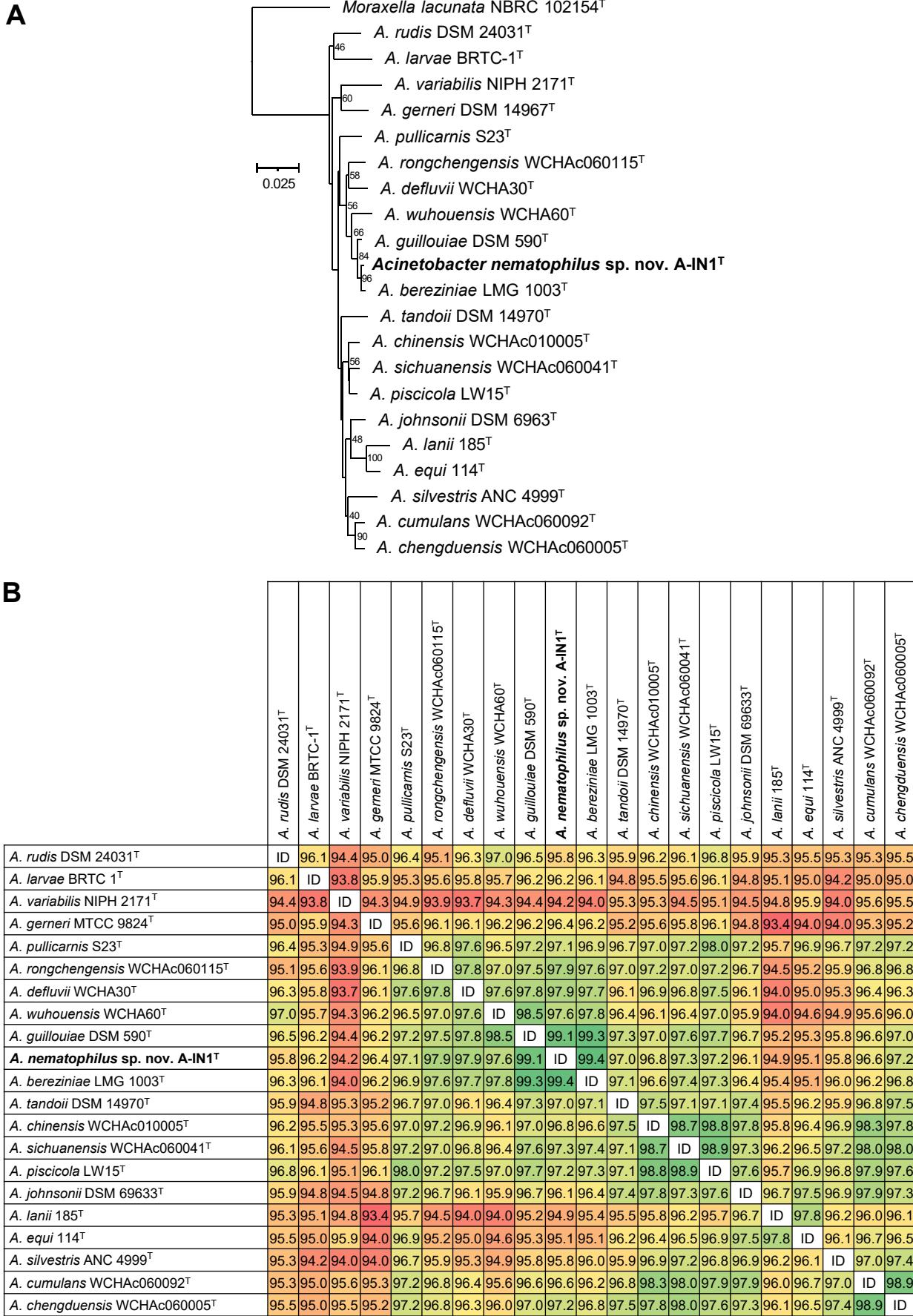


Figure S1. A) Phylogenetic reconstruction based on 16S rRNA gene sequences of several *Acinetobacter* species with validly published names. 1370 nucleotide positions were used in the analyses. Numbers at the nodes represent the percentage of trees in which the associated taxa clustered together. Bars represent nucleotide substitutions per sequence position. Phylogenetic trees were built in Mega 7. B) Pairwise nucleotide similarities (%) of 16S rRNA gene sequences. Colors indicate the degree of relatedness between bacterial species pairs. Bold indicates novel taxonomic proposals. Accession numbers of used gene sequences are shown in Table S1.

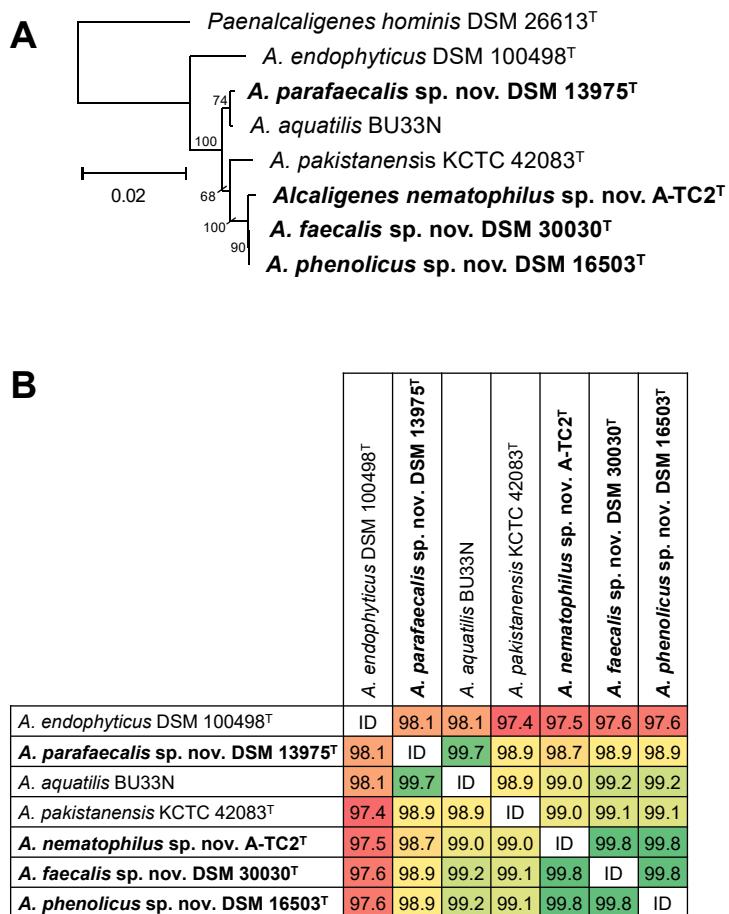
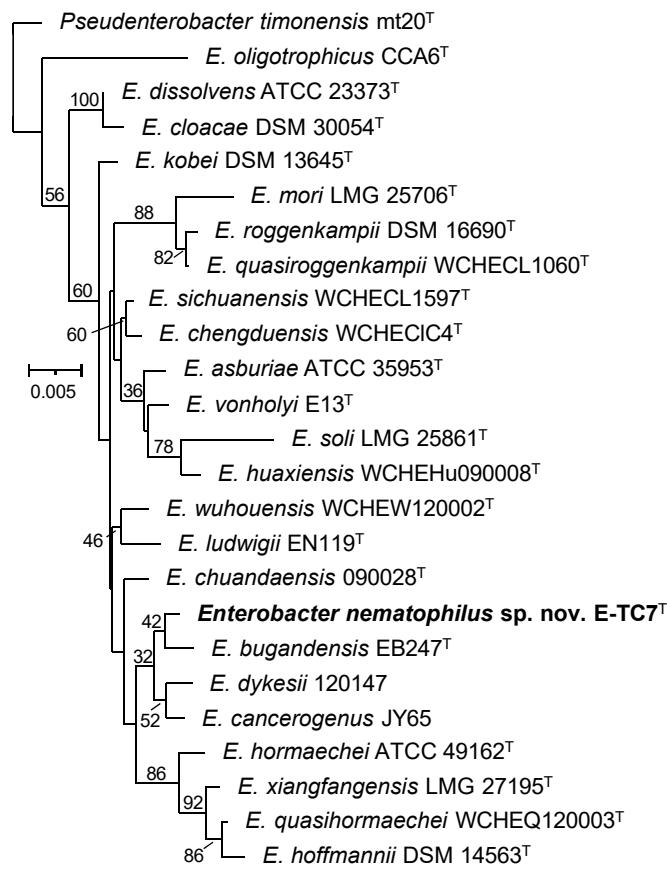


Figure S2. A) Phylogenetic reconstruction based on 16S rRNA gene sequences of all *Alcaligenes* species with validly published names. 1375 nucleotide positions were used in the analyses. Numbers at the nodes represent the percentage of trees in which the associated taxa clustered together. Bars represent nucleotide substitutions per sequence position. Phylogenetic trees were built in Mega 7. B) Pairwise nucleotide similarities (%) of 16S rRNA gene sequences. Colors indicate the degree of relatedness between bacterial species pairs. Bold indicates novel taxonomic proposals. Accession numbers of used gene sequences are shown in Table S1.

A**B**

	<i>E. oligotrophicus</i> CCA6 ^T	ID	97.7	97.7	97.7	97.7	97.2	97.3	97.5	97.5	96.2	96.8	97.2	97.3	97.8	98.2	98.4	97.5	97.1	97.0	96.8	96.8	97.7	97.2	97.1	97.1	
<i>E. dissolvens</i> ATCC 23373 ^T	97.7	ID	99.6	99.1	98.7	98.5	98.5	98.8	98.7	98.7	97.7	98.0	98.7	98.5	98.5	97.6	98.2	98.1	98.5	98.2	98.4	98.0	98.3	97.8	97.5	97.5	
<i>E. cloacae</i> DSM 30054 ^T	97.7	99.6	ID	99.0	98.5	98.5	98.7	98.5	98.7	98.5	98.0	98.9	98.9	98.5	98.5	97.6	98.2	98.1	98.5	98.2	98.4	98.0	98.3	97.8	97.5	97.3	
<i>E. kobei</i> DSM 13645 ^T	97.7	99.1	99.0	ID	99.2	99.0	99.3	99.2	97.9	98.5	99.4	99.2	98.1	98.6	98.7	99.3	99.0	98.9	98.7	99.0	98.7	98.5	98.6	98.8	98.3	98.2	98.1
<i>E. sichuanensis</i> WCHECL1597 ^T	97.2	98.7	98.5	99.2	ID	99.4	99.4	99.3	98.2	98.9	98.7	98.8	98.0	98.6	98.7	99.0	98.7	98.7	98.5	98.6	98.6	98.8	98.3	98.0	97.8		
<i>E. asburiae</i> ATCC 35953 ^T	97.3	98.5	98.5	99.0	99.4	ID	99.5	99.5	98.7	99.2	98.7	99.1	98.2	98.9	98.9	98.8	98.5	98.5	98.7	98.5	98.5	98.8	98.3	98.0	97.8		
<i>E. chengduensis</i> WCHECI-C4 ^T	97.5	98.8	98.7	99.3	99.4	99.5	ID	99.5	98.4	99.0	98.9	99.2	98.3	99.0	99.1	99.1	98.8	98.8	98.7	98.7	98.7	98.9	98.4	98.1	97.9		
<i>E. vonholyi</i> E13 ^T	97.5	98.7	98.5	99.2	99.3	99.5	99.5	ID	98.6	99.2	98.7	98.9	98.0	98.7	98.8	98.7	98.7	98.7	98.7	98.7	98.7	98.6	98.4	98.1	98.0		
<i>E. soli</i> LMG 25861 ^T	96.2	97.7	97.8	97.9	98.2	98.7	98.4	98.6	ID	98.9	97.7	98.2	97.1	97.9	97.7	97.7	97.8	98.0	98.1	97.9	97.7	97.7	97.5	97.2			
<i>E. huaxiensis</i> WCHEHu090008 ^T	96.8	98.0	98.0	98.5	98.9	99.2	99.0	99.2	98.9	ID	98.2	98.6	97.7	98.4	98.4	98.4	98.9	99.0	99.0	99.0	98.2	98.7	98.4	98.2	98.2		
<i>E. ludwigii</i> EN-119 ^T	97.2	98.7	98.9	99.4	98.7	98.7	98.9	98.7	97.7	98.2	ID	99.3	98.2	98.5	98.3	99.3	98.9	98.5	98.5	98.7	99.0	98.4	97.9	98.2	98.1		
<i>E. wuhouensis</i> WCHEW120002 ^T	97.3	98.5	98.5	99.2	98.8	99.1	99.2	98.9	98.2	98.6	99.3	ID	98.6	98.7	98.7	99.4	99.0	99.5	99.0	99.0	98.5	98.0	98.2	98.0			
<i>E. mori</i> LMG 25706 ^T	97.8	97.5	97.6	98.1	98.0	98.2	98.3	98.0	97.1	97.7	98.2	98.6	ID	99.2	99.2	98.3	97.9	97.6	98.0	98.0	98.3	97.8	98.1	98.0			
<i>E. rogenkampii</i> DSM 16690 ^T	98.2	98.1	98.2	98.6	98.6	98.9	99.0	98.7	97.9	98.4	98.5	98.7	99.2	ID	99.8	98.4	98.1	98.1	98.0	98.0	98.8	98.3	98.0	97.9			
<i>E. quasirogenkampii</i> WCHECL1060 ^T	98.4	98.2	98.1	98.7	98.7	98.9	99.1	98.8	97.7	98.4	98.4	98.3	98.7	99.2	99.8	ID	98.5	98.2	98.2	98.2	98.2	99.0	98.5	98.2	98.0		
<i>E. chuandaensis</i> 090028 ^T	97.5	98.7	98.5	99.3	99.0	98.8	99.1	98.7	97.7	98.4	99.3	99.4	98.3	98.4	98.5	ID	99.5	99.0	99.0	99.2	98.9	98.5	98.7	98.5			
<i>E. nematophilus</i> sp. nov. E-TC7^T	97.1	98.4	98.2	99.0	98.7	98.5	98.8	98.7	97.8	98.9	98.9	99.0	97.9	98.1	98.2	98.5	99.5	99.3	99.6	98.6	99.0	99.1	98.9				
<i>E. bugandensis</i> EB-247 ^T	97.0	98.4	98.4	98.9	98.7	98.5	98.8	98.7	98.0	99.0	98.5	98.5	97.6	98.1	98.2	99.0	99.5	99.0	99.3	98.6	98.6	98.1	98.8	98.6			
<i>E. dykesii</i> E1 ^T	96.8	98.0	97.9	98.7	98.5	98.7	98.7	98.7	98.1	99.0	98.7	99.0	98.0	98.0	98.2	99.0	99.3	99.0	99.0	99.5	99.5	98.1	98.6	98.9			
<i>E. cancerogenus</i> ATCC 33241 ^T	96.8	98.3	98.2	99.0	98.6	98.5	98.7	98.7	97.9	99.0	99.0	99.0	98.0	98.0	98.2	99.2	99.6	99.5	99.0	98.2	98.2	98.0	98.8	98.8			
<i>E. hormaechei</i> ATCC 49162 ^T	97.7	98.3	98.2	98.8	98.8	98.8	98.9	98.6	97.7	98.2	98.4	98.5	98.3	98.8	98.9	99.0	98.6	98.6	98.8	98.7	98.7	99.5	99.7	99.4			
<i>E. xiangfangensis</i> LMG27195 ^T	97.2	97.8	97.7	98.3	98.3	98.3	98.4	98.4	97.7	97.9	97.9	98.0	97.8	98.3	98.5	99.0	99.1	98.6	98.7	99.5	ID	99.7	99.4				
<i>E. quasihormaechei</i> WCHEQ120003 ^T	97.1	97.5	97.4	98.2	98.0	98.0	98.1	98.1	97.5	98.4	98.2	98.2	98.1	98.0	98.2	98.7	99.1	98.8	98.9	99.0	99.2	99.7	ID	99.7			
<i>E. hoffmannii</i> DSM 14563 ^T	97.1	97.5	97.3	98.1	97.8	97.8	97.9	98.0	97.2	98.2	98.1	98.0	97.9	98.0	98.5	98.9	98.6	98.7	98.8	98.9	99.4	99.7	ID				

Figure S3. A) Phylogenetic reconstruction based on 16S rRNA gene sequences of all *Enterobacter* species with validly published names. 1405 nucleotide positions were used in the analyses. Numbers at the nodes represent the percentage of trees in which the associated taxa clustered together. Bars represent nucleotide substitutions per sequence position. Phylogenetic trees were built in Mega 7. B) Pairwise nucleotide similarities (%) of 16S rRNA gene sequences. Colors indicate the degree of relatedness between bacterial species pairs. Bold indicates novel taxonomic proposals. Accession numbers of used gene sequences are shown in Table S1.

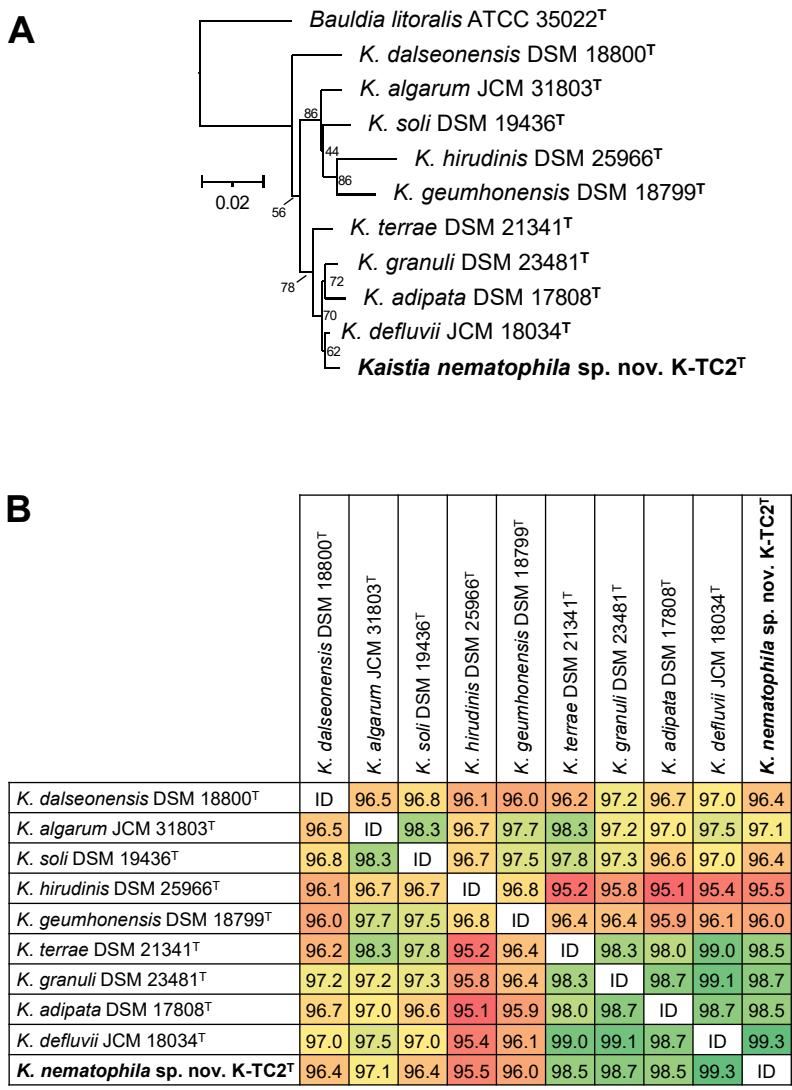


Figure S4. A) Phylogenetic reconstruction based on 16S rRNA gene sequences of all *Kastia* species with validly published names. 1312 nucleotide positions were analyzed. Numbers at the nodes represent the percentage of trees in which the associated taxa clustered together. Bars represent nucleotide substitutions per sequence position. Phylogenetic trees were built in Mega 7. B) Pairwise nucleotide similarities (%) of 16S rRNA gene sequences. Colors indicate the degree of relatedness between bacterial species pairs. Bold indicates novel taxonomic proposals. Accession numbers of used gene sequences are shown in Table S1.

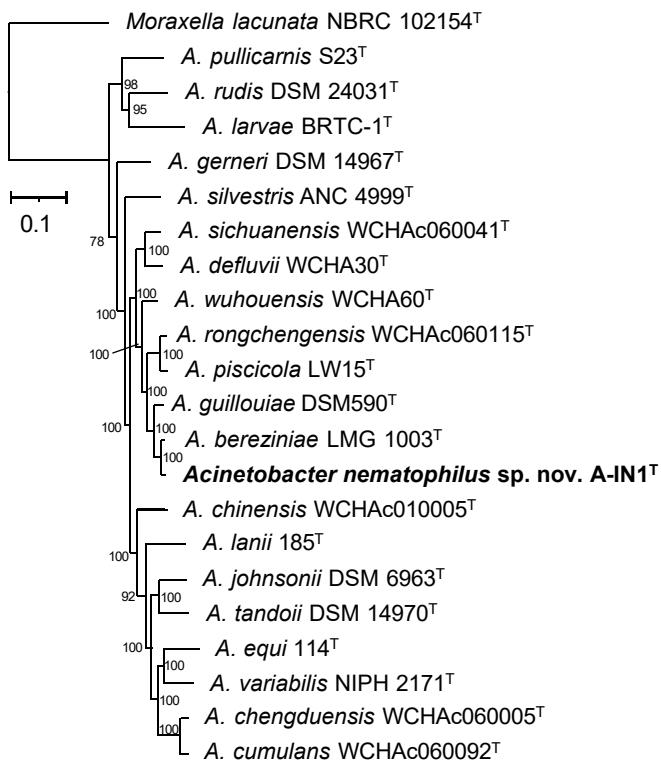
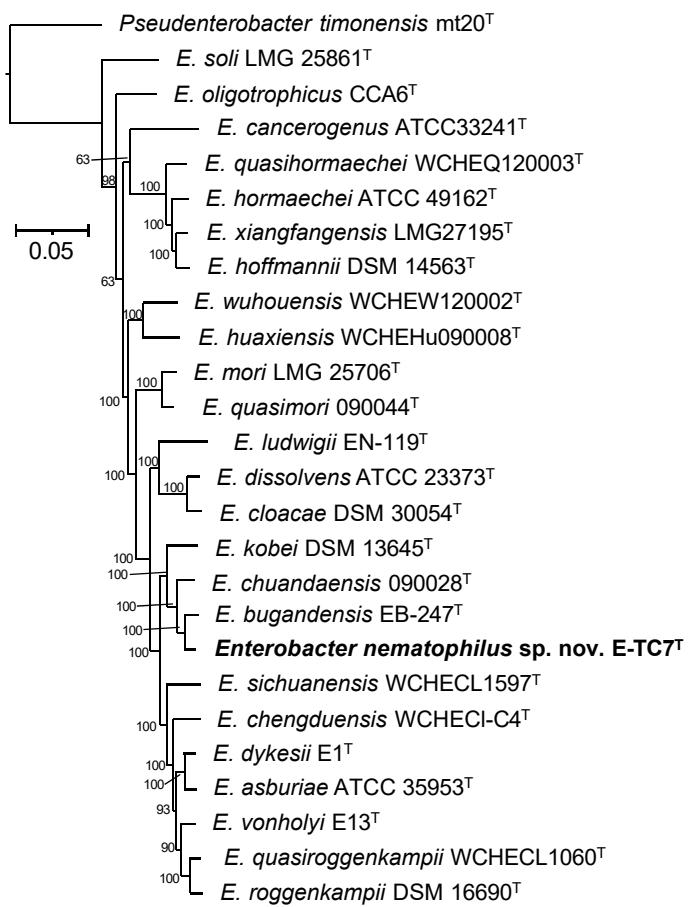
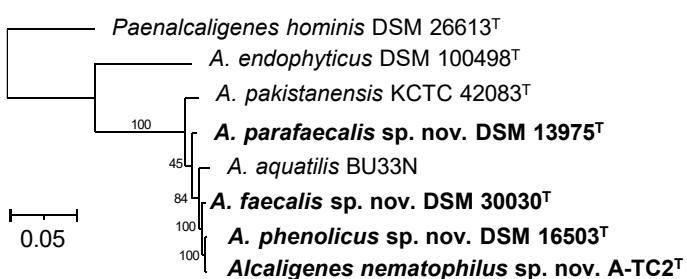
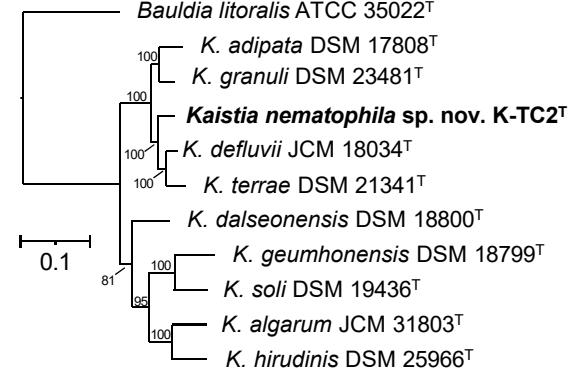
A**C****B****D**

Figure S5. Phylogenetic reconstructions based on core proteome sequences of the type strains of the following genera. A) *Acinetobacter*. A total of 602 core proteins (216249 amino acid positions) were considered in the analyses. B) *Alcaligenes*. A total of 407 core proteins (136588 amino acid positions) were considered in the analyses. C) *Enterobacter*. A total of 3055 core proteins (1015820 amino acid positions) were considered in the analyses. D) *Kastia*. A total of 456 core proteins (161362 amino acid positions) were considered in the analyses. All phylogenetic trees were built using RAxML. Numbers at the nodes represent branch supports. Bar represents amino acid substitutions per sequence position. Bold indicates novel taxonomic proposals. Accession numbers of the genome sequences used are shown in Table S1.

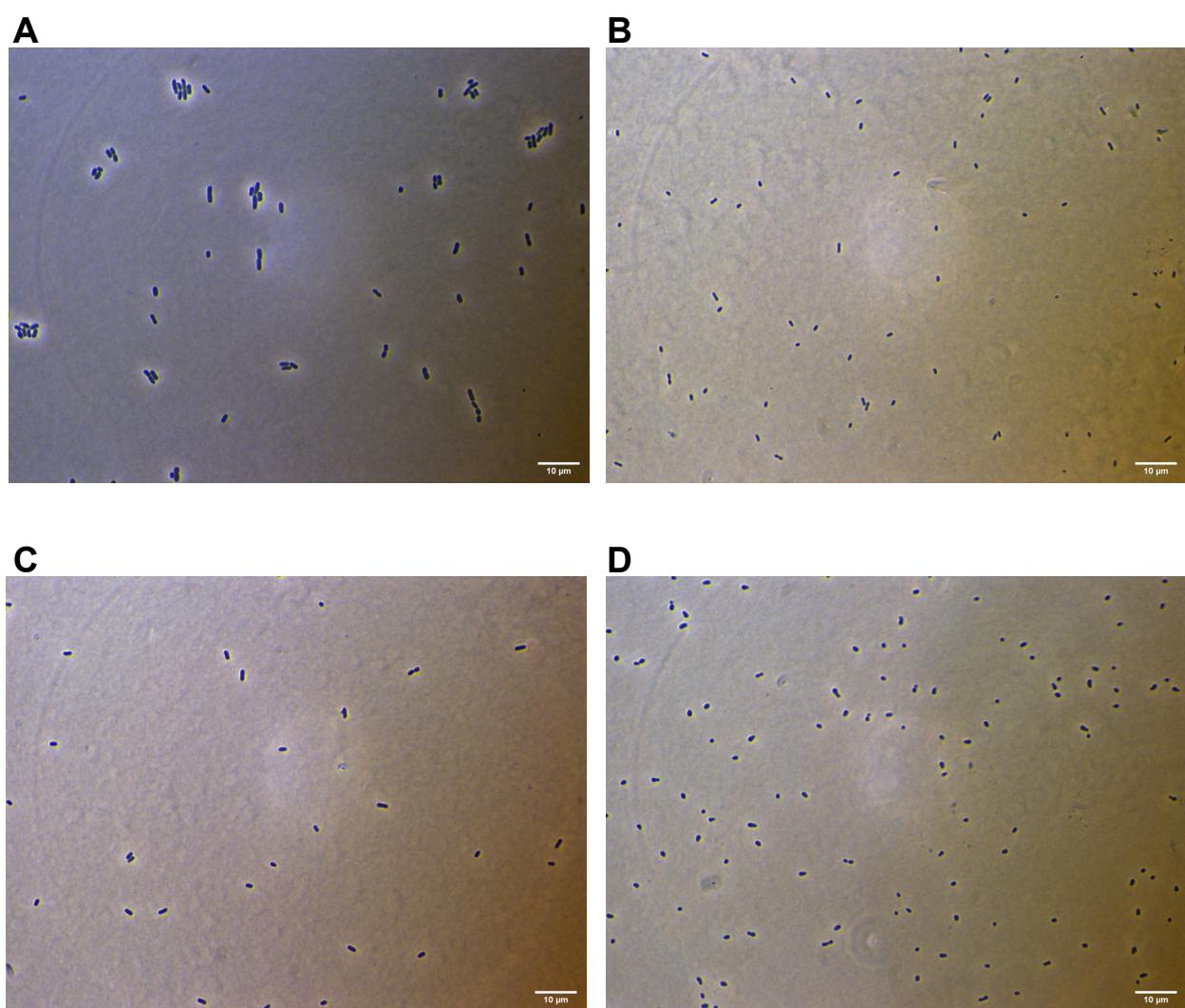


Figure S6. Photographs of the newly described bacterial species. A) *Acinetobacter nematophilus*; B) *Alcaligenes nematophilus*; C) *Enterobacter nematophilus*; D) *Kastia nematophila*. Bars correspond to 10 μm .

-Supplementary Tables-

Table S1. National Center for Biotechnology Information (NCBI) accession numbers of the bacterial sequences used in this study.

Current name	Proposed name	WGS	16S
<i>Acinetobacter bereziniae</i> LMG 1003 ^T		APQG01	OP818094
<i>Acinetobacter chengduensis</i> WCHAc060005 ^T		RCHC01	OP818095
<i>Acinetobacter chinensis</i> WCHAc010005 ^T		NHRR01	OP818096
<i>Acinetobacter cumulans</i> WCHAc060092 ^T		PYIW01	OP818097
<i>Acinetobacter defluvii</i> WCHA30 ^T		MAUF01	OP818098
<i>Acinetobacter equi</i> 114 ^T	Same	CP012808	OP818099
<i>Acinetobacter gernerri</i> MTCC 9824 ^T		APPN01	OP818100
<i>Acinetobacter guillouiae</i> DSM 590 ^T		APOS01	OP818101
<i>Acinetobacter johnsonii</i> DSM 69633 ^T		BBTB01	OP818102
<i>Acinetobacter lanii</i> 185 ^T		CP049916	MK990276
<i>Acinetobacter larvae</i> BRTC 1 ^T		CP016895	OP818103
<i>Acinetobacter</i> sp. A-IN1 ^T		JAPKMY01	OP818110
<i>Acinetobacter piscicola</i> LW15 ^T		NIFO01	OP818104
<i>Acinetobacter pullicarnis</i> S23 ^T		VCMZ01	OP818105
<i>Acinetobacter rongchengensis</i> WCHAc060115 ^T		RAXT01	OP818106
<i>Acinetobacter rufid</i> DSM 24031 ^T	Same	BBRX01	OP818107
<i>Acinetobacter sichuanensis</i> WCHAc060041 ^T		PYIX02	OP818108
<i>Acinetobacter silvestris</i> ANC 4999 ^T		NEGB01	OP818109
<i>Acinetobacter tandoii</i> DSM 14970 ^T		AQFM01	OP818111
<i>Acinetobacter variabilis</i> NIPH 2171 ^T		APRS01	OP818112
<i>Acinetobacter wuhouensis</i> WCHA60 ^T		MBPR02	OP818113
<i>Alcaligenes aquatilis</i> BU33N		CP022390	OP804211
<i>Alcaligenes endophyticus</i> DSM 100498 ^T		JAPKND01	OP804212
<i>Alcaligenes faecalis</i> subsp. <i>faecalis</i> DSM 30030 ^T	<i>Alcaligenes faecalis</i> DSM 30030 ^T	JAPKNC01	OP804215
<i>Alcaligenes</i> sp. A-TC2 ^T	<i>Alcaligenes nematophilus</i> sp. nov. A-TC2 ^T	JAPKMZ01	OP804216
<i>Alcaligenes pakistanensis</i> KCTC 42083 ^T	Same	BMZN01	OP804210
<i>Alcaligenes faecalis</i> subsp. <i>parafaecalis</i> DSM 13975 ^T	<i>Alcaligenes parafaecalis</i> sp. nov. DSM 13975 ^T	JAPKNA01	OP804213
<i>Alcaligenes faecalis</i> subsp. <i>phenolicus</i> DSM 16503 ^T	<i>Alcaligenes phenolicus</i> sp. nov. DSM 16503 ^T	JAPKNB01	OP804214
<i>Bauldia litoralis</i> ATCC 35022 ^T	Same	FMXQ01	OP804315
<i>Enterobacter asburiae</i> ATCC 35953 ^T		CP011863	OP818065
<i>Enterobacter bugandensis</i> EB-247 ^T		LT992502	OP818066
<i>Enterobacter cancerogenus</i> ATCC33241 ^T		FYBA01	OP818067
<i>Enterobacter chengduensis</i> WCHECI-C4 ^T		MTSO01	OP818068
<i>Enterobacter chuandaensis</i> 090028 ^T		QZCS01	OP818069
<i>Enterobacter cloacae</i> DSM 30054 ^T		CP056776	OP818070
<i>Enterobacter dissolvens</i> ATCC 23373 ^T		WJWQ01	OP818071
<i>Enterobacter dykesii</i> E1 ^T		VTTY01	OP818072
<i>Enterobacter hoffmannii</i> DSM 14563 ^T		CP017186	OP818073
<i>Enterobacter hormaechei</i> ATCC 49162 ^T		MKEQ01	OP818074
<i>Enterobacter huaxiensis</i> WCHEHU090008 ^T		QZCT01	OP818075
<i>Enterobacter kobei</i> DSM 13645 ^T		CP017181	OP818076
<i>Enterobacter ludwigii</i> EN-119 ^T		CP017279	OP818077
<i>Enterobacter mori</i> LMG 25706 ^T		AEXB01	OP818078
<i>Enterobacter</i> sp. E-TC7 ^T	<i>Enterobacter nematophilus</i> sp. nov. E-TC7 ^T	JAPKNE01	OP818089
<i>Enterobacter oligotrophicus</i> CCA6 ^T	Same	AP019007	OP818079
<i>Enterobacter quasihormaechei</i> WCHEQ120003 ^T		SJON01	OP818080
<i>Enterobacter quasimori</i> 090044 ^T		RXRX01	N/A
<i>Enterobacter quasiroggenkampii</i> WCHECL1060 ^T		LFDQ02	OP818081
<i>Enterobacter rogenkampii</i> DSM 16690 ^T		CP017184	OP818082
<i>Enterobacter sichuanensis</i> WCHECL1597 ^T		POVL01	OP818083
<i>Enterobacter soli</i> LMG 25861 ^T		FYBB01	OP818084
<i>Enterobacter vonholty</i> E13 ^T		VTUC01	OP818085
<i>Enterobacter wuhouensis</i> WCHEW120002 ^T		SJOO01	OP818086
<i>Enterobacter xiangfangensis</i> LMG27195 ^T		CP017183	OP818087
<i>Kaistia adipata</i> DSM 17808 ^T		AUHO01	OP804307
<i>Kaistia algarum</i> JCM 31803 ^T		JAPKNJ01	OP804306
<i>Kaistia dalseonensis</i> DSM 18800 ^T		JAPKNG01	OP804311
<i>Kaistia defluvii</i> JCM 18034 ^T		JAPKNI01	OP804313
<i>Kaistia geumhoniensis</i> DSM 18799 ^T		JAPKNF01	OP804312
<i>Kaistia granuli</i> DSM 23481 ^T		AQYH01	OP804308
<i>Kaistia hirudinis</i> DSM 25966 ^T		JACIDS01	OP804314
<i>Kaistia</i> sp. K-TC2	<i>Kaistia nematophila</i> sp. nov. K-TC2 ^T	JAPKNK01	OP804305
<i>Kaistia soli</i> DSM 19436 ^T	Same	FQUP01	OP804309
<i>Kaistia terra</i> DSM 21341 ^T		JAPKNH01	OP804310
<i>Moraxella lacunata</i> NBRC 102154 ^T		BCUK01	OP818114
<i>Paenacaligenes hominis</i> DSM 26613 ^T		JAATIZ01	OP804230
<i>Pseudoenterobacter timonensis</i> mt20 ^T		FCOP01	OP818088

Table S2. Features of the genomes generated in this study. 1: *Acinetobacter nematophilus* sp. nov. A-IN1^T; 2: *Alcaligenes endophyticus* DSM 100498^T; 3: *Alcaligenes faecalis* DSM 30030^T; 4: *Alcaligenes nematophilus* sp. nov. A-TC2^T; 5: *Alcaligenes parafaecalis* sp. nov. DSM 13975^T; 6: *Alcaligenes phenolicus* sp. nov. DSM 16503^T; 7: *Enterobacter nematophilus* sp. nov. E-TC7^T; 8: *Kaistia algarum* JCM 31803^T; 9: *Kaistia dalseonensis* DSM 18800^T; 10: *Kaistia defluvii* JCM 18034^T; 11: *Kaistia geumhonensis* DSM 18799^T; 12: *Kaistia nematophila* sp. nov. K-TC2^T; and 13: *Kaistia terrae* DSM 21341^T.

Table S3. Features of the bacterial genomes generated in this study.

Bacterial strain	Base pairs	Percent G+C	No. proteins
<i>Acinetobacter nematophilus</i> sp. nov. A-IN1 ^T	4360075	38.49	4046
<i>Alcaligenes nematophilus</i> sp. nov. A-TC2 ^T	4251628	56.41	3892
<i>Alcaligenes parafaecalis</i> sp. nov. DSM 13975 ^T	4004626	56.02	3624
<i>Alcaligenes phenolicus</i> sp. nov. DSM 16503 ^T	4238760	56.42	3909
<i>Alcaligenes faecalis</i> DSM 30030 ^T	4003996	56.65	3706
<i>Alcaligenes endophyticus</i> DSM 100498 ^T	3557226	50.05	3270
<i>Enterobacter nematophilus</i> sp. nov. E-TC7 ^T	4708215	56.36	4289
<i>Kaistia dalseonensis</i> DSM 18800 ^T	5184115	64.91	4833
<i>Kaistia geumhonensis</i> DSM 18799 ^T	4581777	67.76	4293
<i>Kaistia terrae</i> DSM 21341 ^T	5594089	63.84	5203
<i>Kaistia defluvii</i> JCM 18034 ^T	4901180	65.71	4523
<i>Kaistia algarum</i> JCM 31803 ^T	5259198	64.74	4949
<i>Kaistia nematophila</i> sp. nov. K-TC2 ^T	5165915	66.75	4789

Table S4. Completeness (%) and contamination (%) of the bacterial genomes generated in this study assessed by checkM.

Bacterial strain	Completeness (%)	Contamination (%)
<i>Acinetobacter nematophilus</i> sp. nov. A-IN1 ^T	99.93	1.58
<i>Alcaligenes endophyticus</i> DSM 100498 ^T	100.0	0.50
<i>Alcaligenes faecalis</i> DSM 30030 ^T	100.0	0.00
<i>Alcaligenes nematophilus</i> sp. nov. A-TC2 ^T	100.0	0.05
<i>Alcaligenes parafaecalis</i> sp. nov. DSM 13975 ^T	100.0	0.00
<i>Alcaligenes phenolicus</i> sp. nov. DSM 16503 ^T	100.0	0.00
<i>Enterobacter nematophilus</i> sp. nov. E-TC7 ^T	99.95	0.08
<i>Kaistia algarum</i> JCM 31803 ^T	99.37	0.90
<i>Kaistia dalseonensis</i> DSM 18800 ^T	100.0	0.00
<i>Kaistia defluvii</i> JCM 18034 ^T	99.68	0.47
<i>Kaistia geumhonensis</i> DSM 18799 ^T	100.0	0.16
<i>Kaistia nematophila</i> sp. nov. K-TC2 ^T	100.0	0.82
<i>Kaistia terrae</i> DSM 21341 ^T	99.68	0.58

Table S5. Source of the bacterial strains used in this study.

Strain	Source
<i>Acinetobacter bereziniae</i> DSM 25435 ^T	German Collection of Microorganisms and Cell Cultures (DSMZ)
<i>Acinetobacter guillouiae</i> DSM 590 ^T	DSMZ
<i>Acinetobacter nematophila</i> A-IN1 ^T	This study
<i>Alcaligenes endophyticus</i> DSM 100498 ^T	DSMZ
<i>Alcaligenes faecalis</i> subsp. <i>faecalis</i> DSM 30030 ^T	DSMZ
<i>Alcaligenes nematophila</i> A-TC2 ^T	This study
<i>Alcaligenes faecalis</i> subsp. <i>parafaecalis</i> DSM 13975 ^T	DSMZ
<i>Alcaligenes faecalis</i> subsp. <i>phenolicus</i> DSM 16503 ^T	DSMZ
<i>Enterobacter bugandensis</i> DSM 29888 ^T	DSMZ
<i>Enterobacter chuandaensis</i> CNCTC 7649 ^T	Czechoslovak National Collection of Type Cultures (CNCTC)
<i>Enterobacter kobei</i> DSM 13645 ^T	DSMZ
<i>Enterobacter nematophila</i> E-TC7 ^T	This study
<i>Kaistia algarum</i> KACC 19096 ^T	Korean agricultural culture collection (KACC)
<i>Kaistia dalseonensis</i> DSM 18800 ^T	DSMZ
<i>Kaistia defluvii</i> JCM 18034 ^T	Japan Collection of Microorganisms (JCM)
<i>Kaistia geumhonensis</i> DSM 18799 ^T	DSMZ
<i>Kaistia nematophila</i> K-TC2 ^T	This study
<i>Kaistia terrae</i> DSM 21341 ^T	DSMZ