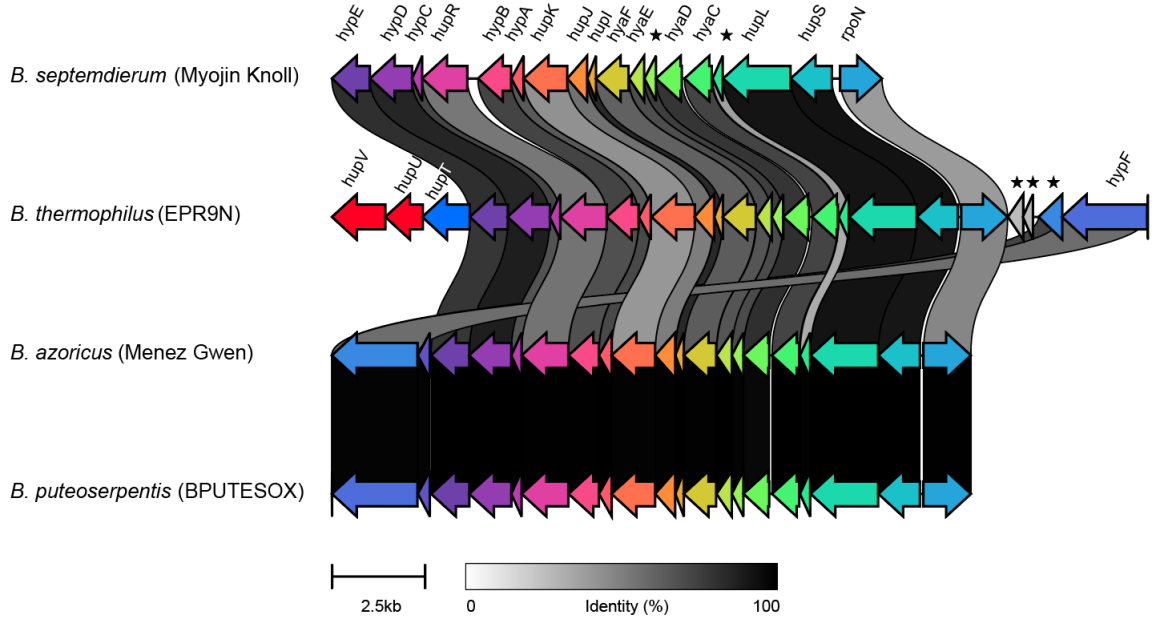
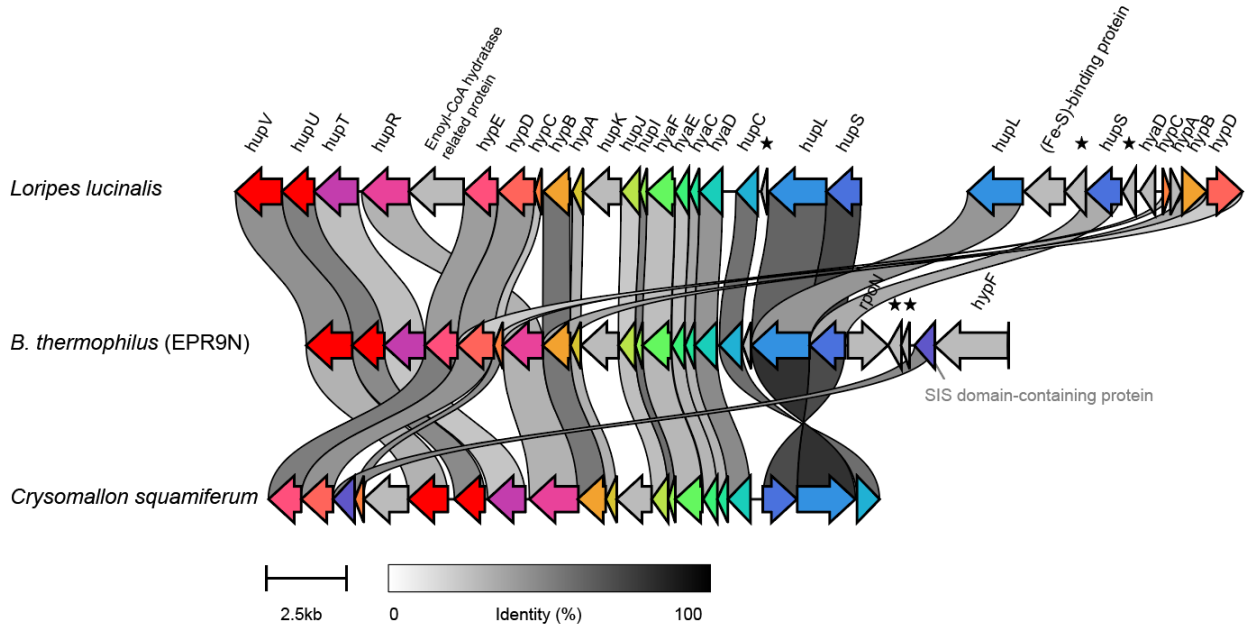
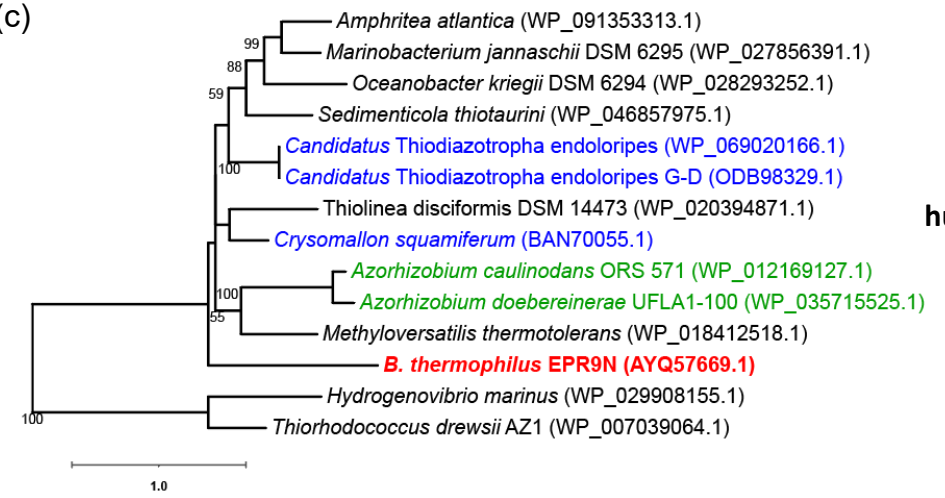
(a)


hypE
hypD
hypC
hypR
hypB
hypA
hupK
hupJ
hupI
hyaF
hyaE
hyaD
hyaC
hupL
hupS
rpoN
B. septemdierum (Myojin Knoll)
hupV
hupU
hupT
hypF
B. thermophilus (EPR9N)
B. azoricus (Menez Gwen)
B. puteoserpentis (BPUTESOX)
2.5kb
0
Identity (%)
100

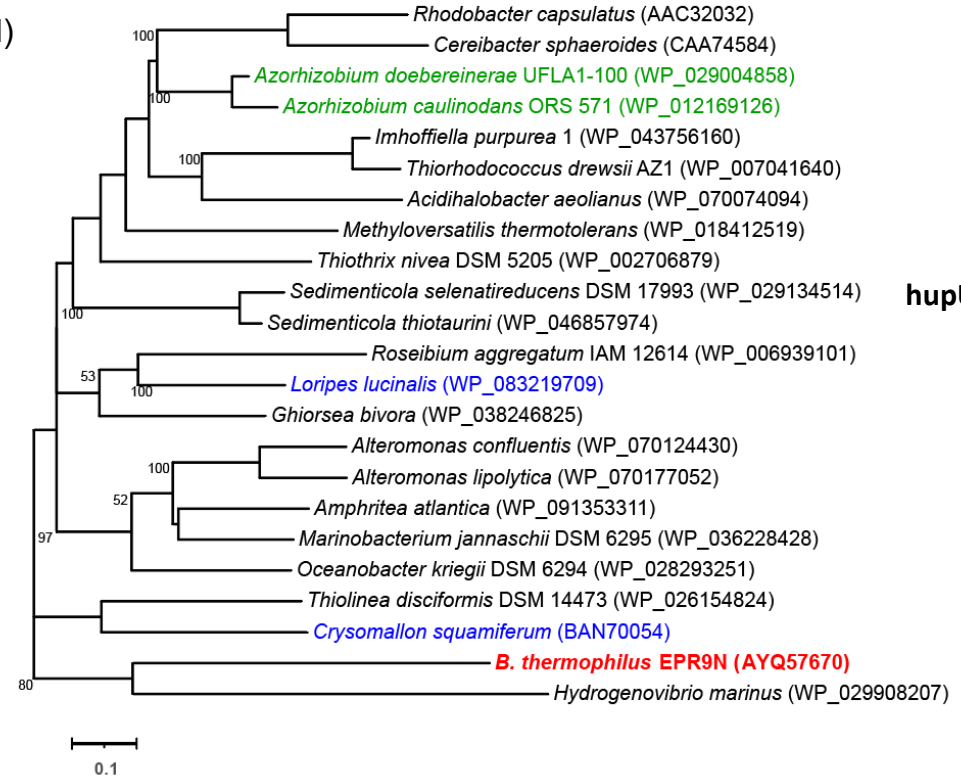
(b)


hupV
hupU
hupT
hupR
Enoyl-CoA hydratase related protein
hypE
hypD
hypC
hypB
hypA
hupK
hupJ
hupI
hyaF
hyaE
hyaC
hyaD
hupC
hupL
hupS
hupL
(Fe-S)-binding protein
hupS
hyaD
hypC
hypA
hypB
hypD
Loripes lucinalis
B. thermophilus (EPR9N)
rpoN
hypF
SIS domain-containing protein
Crysomallon squamiferum
2.5kb
0
Identity (%)
100

(c)


Amphritea atlantica (WP_091353313.1)
Marinobacterium jannaschii DSM 6295 (WP_027856391.1)
Oceanobacter kriegii DSM 6294 (WP_028293252.1)
Sedimenticola thiotaurini (WP_046857975.1)
Candidatus Thiodiazotropha endoloripes (WP_069020166.1)
Candidatus Thiodiazotropha endoloripes G-D (ODB98329.1)
Thiolinea disciformis DSM 14473 (WP_020394871.1)
Crysomallon squamiferum (BAN70055.1)
Azorhizobium caulinodans ORS 571 (WP_012169127.1)
Azorhizobium doebereinerae UFLA1-100 (WP_035715525.1)
Methyloversatilis thermotolerans (WP_018412518.1)
B. thermophilus EPR9N (AYQ57669.1)
Hydrogenovibrio marinus (WP_029908155.1)
Thiorhodococcus drewsii AZ1 (WP_007039064.1)
99
88
59
100
100
55
100
1.0
hupV

(d)


Rhodobacter capsulatus (AAC32032)
Cereibacter sphaeroides (CAA74584)
Azorhizobium doebereinerae UFLA1-100 (WP_029004858)
Azorhizobium caulinodans ORS 571 (WP_012169126)
Imhoffiella purpurea 1 (WP_043756160)
Thiorhodococcus drewsii AZ1 (WP_007041640)
Acidihalobacter aeolianus (WP_070074094)
Methyloversatilis thermotolerans (WP_018412519)
Thiothrix nivea DSM 5205 (WP_002706879)
Sedimenticola selenatireducens DSM 17993 (WP_029134514)
Sedimenticola thiotaurini (WP_046857974)
Roseibium aggregatum IAM 12614 (WP_006939101)
Loripes lucinalis (WP_083219709)
Ghiorsea bivora (WP_038246825)
Alteromonas confluentis (WP_070124430)
Alteromonas lipolytica (WP_070177052)
Amphritea atlantica (WP_091353311)
Marinobacterium jannaschii DSM 6295 (WP_036228428)
Oceanobacter kriegii DSM 6294 (WP_028293251)
Thiolinea disciformis DSM 14473 (WP_026154824)
Crysomallon squamiferum (BAN70054)
B. thermophilus EPR9N (AYQ57670)
Hydrogenovibrio marinus (WP_029908207)
100
100
100
100
53
100
100
52
97
80
0.1
hupU