

**Table S1.** Accession numbers of helicase DEAD/DEAH genes used in this study

Codename	Taxon	Accession no.
AeI_hel_1	Aedes	EAT386561
AeI_hel_2	Aedes	EAT41563
AB_hel__	Bacteria	archaeon
AD_HYP1_D	Aplysia	AASC01031229
AD_HYP2_D	Aplysia	AASC01159495
AD_HYP3_D	Aplysia	gbAASC01109799
AfA_hel__	Archaea	NP070287
Ao_F_hel_	fungus	XP753471
AfF_ifhi_	fungus	XP749133
AgI_hel1_	Anopheles	EAA00143XP320199
AgI_hel2_	Anopheles	EAA00171
AgI_hel3_	Anopheles	EAA004563
AgI_hel4_	Anopheles	EAA02455
AgI_hel5_	Anopheles	EAA04138
AgI_hel6_	Anopheles	EAA04660
AgI_hel7_	Anopheles	EAA07044XP559208
AgI_hel8_	Anopheles	EAA07398
AgI_hel9_	Anopheles	EAA08469
AgI_hel10	Anopheles	EAA09253
AgI_hel11	Anopheles	EAA101833
AgI_hel12	Anopheles	314684EAA10198
AgI_hel13	Anopheles	EAA11295XP315400
AgI_hel14	Anopheles	EAA11913XP315948
AgI_hel15	Anopheles	EAA12654
AgI_hel16	Anopheles	EAA13218XP318117
AgI_hel17	Anopheles	EAA13221
AgI_hel18	Anopheles	EAA14161

AgI_hel19	Anopheles	EAA14744XP319825
AgI_hel20	Anopheles	EAL38704XP551895
AgI1DIC_D	Anopheles	XP309566
AgI_hel21	Anopheles	XP311385
AgI2DIC_D	Anopheles	XP3219592
AgI_hel22	Anopheles	XP3109692
AmI1DIC_D	Apis	XP001120496
AmI2DIC_D	Apis	XP001122561
AmI_hel1_	Apis	XP393083CG7922PA
AmI_hel2_	Apis	XP394691
AmI_hel3_	Apis	XP6245102
AmI_hel4_	Apis	XP624800
Ao_F_hel_	Aspergillus	BAE55820
AtP_DCL_D	Arabidopsis	NP5661993
AtP_hel__	Arabidopsis	NP174785
BF_C1_D__	Bradyrhizobium	CAL79857
BtB_hel__	Burkholderia	YP439173
BtM_helM_	Bos	P615590
BtM_helR_	Bos	P580928
BtM_helU_	Bos	XP591336
BtM_hel1_	Bos	NP001015545
BtM_hel2_	Bos	NP9762351
CaF_hel_D	Candida	XP718614
CbW1DEA_D	Ceanarhabditis	DUCAE56725
CbW2DEA_D	Ceanarhabditis	UCAE61499
CeW_hel1_	Ceanarhabditis	CAE615011CBG05400, NP501018A88708
CbW_hel2_	Ceanarhabditis	CAE66840
CeW_hel3_	Ceanarhabditis	P34529CAE75060
CeW_hel4_	Ceanarhabditis	NP490989CAE60391
CeW_hel5_	Ceanarhabditis	NP492829

CeW_hel6_	Ceanarhabditis	CAE64461
CeW_DEA_D	Ceanarhabditis	NP501960
CfM_DEA_D	Canis	RWGA39
CfM1_hel_	Canis	XP537547
CiV_hel__	Ciona	AABS01000049
CiV_DIC_D	Ciona	AABS01000110
CjB_hel__	Campylobacter	YP001000786
CbE_hel__	Bacteria	XP5683221
CpB_top_D	Clostridium	YP699468
CrA_hel__	Archaea	BAE95223
CsV_DIC_D	Ciona	AACT01042303
DdE1_hel_	Bacteria	XP0011346281
DdE2_hel_	Bacteria	UXP644014
DdE3_hel_	Bacteria	XP635263CAC41974
DmI1_hel_	Drosophila	NP523778CG6493PA
DmI2_hel_	Drosophila	NP524019
DmI3_hel_	Drosophila	NP572330
DmI4_hel_	Drosophila	NP572632
DmI5_hel_	Drosophila	NP609599
DmI6_hel_	Drosophila	NP6509712CG7922PA
DmI1DIC_D	Drosophila	NP732463
DmI2DIC_D	Drosophila	NP9961851
TcI_hel__	Tribolium	XP9689931CG4792PA
DmI7_hel_	Drosophila	NP524453CG4792PA
DrB_tn3_D	Drosophila	YP001113172
DrV_heM_D	Danio	NP001074053
DrV_heR_D	Danio	P001339107
DrV_DEA_D	Danio	DUNC007125
DrV_DEA_D	Danio	MAAH97103
DrV1_hel_	Danio	NC007118

DrM_hel__	Drosophila	XP683015	
DrV2_hel_	Danio	XP694124	
DrV_mgc_D	Danio	XP701089	
EcB_hel__	Bacteria	YP050432	
EuA_hel__	Archaea	AAT10146	
PfA_hel__	Archaea	1WP9	
FrV1_hel_	Fugo	CAAB01000424	
FrV2_hel_	Fugo	CAAB010000381Fugo	
GgV1_hel_	Gallus	XP422365	
GgV_DAE_D	Gallus	UAADN02003674	
GgV2_hel_	Gallus	XP422031	
GgM_hel__	Gallus	NP001035555	SPALQ
HaA_hel__	Archaea	NP2809761	
HsM_DEA_D	Homo	UBAB71141	
HsM_hel__	Homo	UBAC04159	
HsM_hel__	Homo	MAAG54076AAD19826	
HsM_hel__	Homo	NP077024	
HsM_hel__	Homo	NP803187Q9UPY3	S
MaA1_hel_	Archaea	CAJ36563	
MaA2_hel_	Archaea	NP615070	
MaM_helR_	Macaca	NP001036133	
MaM_helM_	Macaca	NP001040588114052719	
MaM1_hel_	Macaca	XP001108799	
MaM2_hel_	Monodelphis	XP0011008681	
MdM_helM_	Monodelphis	126326479XP001374256	
MhA_hel__	Archaea	YP503150	
MjA_hel__	Archaea	NP248512H64487	
MkA_hel__	Archaea	NP614961	
MmM1_helM	Mus	BAE31652AAH80200	
MmM_DEA_D	Mus	UBAC33670	

MmM2_hel_	Mus	NP084426
MmM3_hel_	Mus	BAC15765Q8R4181683750AAL84638
MsA_hel__	Archaea	YP447070
MtA_hel__	Archaea	YP842666
NeA_hel__	Archaea	NP963674
OvV1_hel_	Oryzias	BAAF030189101
OvV2_hel_	Oryzias	BAAF030339341
OvV3_hel_	Oryzias	BAAF03033934
PpM_hel__	Pongo	CAH89418
PtE_helU_	Paramecium	CAI39097
PtM1_hel_	Pan	UXP509928
PtM2_hel_	Pan	XP001154010
PyE_IFH_D	Plasmodium	XP731192
RrM1_helM	Rattus	XP001055482
RrM2_hel_	Rattus	XP001081462
RrM3_hel_	Rattus	XP001069041
SmE_hel__	Strongylocentrotus	CAJ00235
SpD1_hel_	Strongylocentrotus	XP001180482
SpD2_hel_	Strongylocentrotus	XP0012041351
SpD_DIC_D	Strongylocentrotus	XP001181040
SpD1HYP_D	Strongylocentrotus	AAGJ02005534
SpD2HYP_D	Strongylocentrotus	AAGJ02010786
SpD3_hel_	Strongylocentrotus	gbAAGJ02119714, AAGJ02133742
SpF1_hel_	Strongylocentrotus	NP5936241
SpF2_hel_	Strongylocentrotus	NP588215
SsM_helR_	Sus	Q9GLV6
TaA_hel__	Archaea	NP394951
TbE_hel__	Trypanosoma	XP822979
TbE_DEA_D	Trypanosoma	UXP823244
TcE1_hel_	Trypanosoma	EAN83446XP823259

TcE2_hel_	Trypanosoma	EAN87505XP845920	LVRDH
TcE1DEA_D	Trypanosoma	UEAN80693	
TcE3_hel_	Trypanosoma	XP845112EAN838541EAN83854	GS
TbE4_hel_	Trypanosoma	XP828952	VP
TcE5_hel_	Trypanosoma	EAN89008	
TcE2DEA_D	Trypanosoma	UEAN90577	
TcE6_hel_	Trypanosoma	EAN90635	
TcE7_hel_	Trypanosoma	XP846985EAN95108	
TcE3DEA_D	Trypanosoma	UEAN95665	
TcE8_hel_	Trypanosoma	EAN97670XP822871	
TcE9_hel_	Trypanosoma	EAN99766	
TcI1_hel_	Trypanosoma	XP966623	
TcI_DIC_D	Trypanosoma	XP968684	
TcI2_hel_	Trypanosoma	9736701CG7922PA	
TnV1_hel_	Trypanosoma	CAG10454	
TnV2_hel_	Trypanosoma	CAG09339	
TnV3_hel_	Trypanosoma	CAG02830	
TnV4_hel_	Trypanosoma	embCAAE010150041	
TtE_DEA_D	Tetrahymena	UBAD347221	
TtE1_hel_	Tetrahymena	EAS01066	
TtE2_hel_	Tetrahymena	EAS03211	
XIV_hel_	Xenopus	AAH73528MGC82787	
TcE10_hel	Trypanosoma	XP807714	
TcI3_hel_	Trypanosoma	XP967018	
AgI22_hel	Anopheles	XP309062	
AmI_hel5_	Apis	XP001123361	
CfM2_hel_	Canis	XP860567	
DrV3_hel_	Dnio	CAAK03020666	
DrV4_hel_	Dnio	CAAK03040844	
GgV3_hel_	Gallus	XP4258711PRED	

MmM4_hel_	Mus	BAE29095BAE33716
MmM5_helR	Mus	Q6Q899
LiE_hel__	Leishmania	68128582146096652CD
MmM6_helU	Mus	BAC35487
MmM7_helU	Mus	BAE31919
OvV4_hel_	Oryzias	BAAF03138338
PtM3_hel_	Pan	XP001167022
TcE11_hel	Trypanosoma	EAN98055