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concatenated and filtered alignment used for Figure 3 tree

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>SGPV

MNSVLISAKQLENEYESTDMFGCPIITGTSYMPIHVESNGVEYMVYSFNINDKEINAFNKFILSFEVSEL
HSNHPIAYVPYFGFKLIKKVAIYDENNKVIEDGATLFSRALSKKDNISTSGYSKELNNFNINYTENTYFL
PSTQINVPLNIFYPNQDTFSTIKPNNSFLRIEVTMELTNMVMVNPAYEKPLVNTLSIKKPVLGIVVYSV
QNRSTNQYIINNYESVGNVEDDEHYVHGIDNVSHINFDVGNLSGKRFRMVWAGHDQSESNWTNMYLKKLL
TEIIILPNGVNDGNSPKAKY-

QIMKNKIELGIKTIDLVIERPKNYSAWFHTNPLVFNRENKTQSTYNIVEKINVHCSWNILQNNFVFEID
HQITIGDISVPIEIWNVNTKSDEGDNRSVLCKNSDVIINDPFFRGVDFLNKQRPIEAIATVKHGNETLYQS
HLNACYYNPFMTKGYGNI----

SFCHHTTAVCPNYLPSDHIRGRCQIGIKAVWANQDKSTPHYHISKLLIIQYGVVSKVSSVNKRNITSILN
MNYQNEIYIKPLKTSKIPLDNKFEHTKIFSSPD-EVYKWANGSNETYEHIVSDT--

AVKLFWDIDIDLTKSDQETLESNPYMKILASLAYMKNGLKEYNEAVLMTNAAVVTKSNNCDKISYHVI
YPNFLVAPNDWCMLTKSLEGLVNSQINNLLKAIDFVVWKEFPTLRCAYSIKSCEDTSVHVII--

GT FEDSLISWIPETTKAQYWLITHEEADSLDPSNSLYNEVNRILTEVFTQLEHYDYIEG-
QTYQLDVDYCNPCPICFVSLHKNHFCKRQKGLIISKHGNPKCKVHTLLKEDLYLTI AVDIYSRNDIKK

YQEDHFIIWNGVNWVSDKATYSITSYILRISSSIEDSIKELQDYRKRKMVENNLIDLINPIRVDSIPYV
LYFQNGCYNIKDEFYEGPSAKEYIGSVNTGYMYKSAWIDEDQNAMKDIDIIDQIQPTENKEERELEYEII

LGSCLYGSHKEYMTFFHGDMSGKSTSKKIVNAAIGNFMLETNSNLLTEVIDKRPNPFLAQINHKRALFA
SELTADSKFKIKGVNVKLLTDHKIISRLCYSNAIEQQNFATFIVDTNHEPFFDIVDGAIVRRCLMINFKS

AFIEKSR-
ILVGVKNIFFIRMEISSRLETQAYRQACFLILKRFFRKHFLTLPFKTTPEFKDFTLIRKIPTLIVQSST

ETIEILPKYSAKYDTGDTVMEEFYSYIKHFSIKLFGNEIQNMITHSHTTSGHIWVKYIVKHLITYMN
SVLKILENNHSRLTILPHQMATVDFALKTIIDNKMSAMIFHDMGSGKTFVALIFALLISTEKNVVIILP

NNNILEIWQSKIYQVQSLIGPCDMDKIKMYSISTFILLKSTNDEIDTNKIMDCQDSVFIVDEAHIIFGN
ATGKFLITIKQKTNVLFMLLTGSPISNTPKALVHIIRLMTGSDISPPKLIQKTKIIHISLNETGKELLE

SLLKGQISYYKNGESIPTPKYIGQPVLNIPMIQCPMENIQEVDYDKTREMSSNEMFETMVVNVSMCALG
QINFINNLAFFFF--

TSLLPNLKSNDGLLTGQDLVTLDISSKFKYFMKYITEGEKHLIYFSNATYGTLIIRSIMLANGINEYKGA
NAKDPICFCKHKTFTILTSRVNESITPTLEVFNTRNKHGHFISLLFASYALGQSYTLKEVKNLWFLTIP

DTYSQYQTIIGRAIRKFSYENPNEEVKIRILSCVPKYYKHK--
QLKPDMDDEIDKLPFDIKKQYYLESKSNESKIYSIFQGISKYKDPVHKNLWRMTMVVELLRIYFKSHPRV

KRTDSKFMFTMPGPDETLNKIITELLDAHVQILNDIFGSCLLYWGNDEIITVPIQLTLPKHCISIPLTK
EENIVQDKVCITFLIRDGWGKPSYMAGKSRTGEIIWFKTFLPCCYLMYTSDADELEGTYRFIGQFTILDN

TYKGINCAFKKTKELSLCTKPNLHCTEKSYSYGLQWFFVFNKINPAGSYSFNPIREESPNVWKS DLM
PF-EPIPYFCPPLMILSFDLECYTVGQF-SPQTQPITHCA-

ITLDKTKSKFCLVDTKSIPDSKIKRSDSWCNDQEFYSVYKYFYMVEKQLLLVIKGFLESQIDYVLTYNH
CMDIPYVNRLEVYGPLITKIPSTDTETPL-

VFKKSKNLLSTERCDIYSANGTLFFDLHNFVKKEEGLNSYSLEALSCKNFNGYGTLLKGTDWTWFRSTKN
KSLYFTKLLSAGFINLDN--YLPICNKVIT---

ETVLSFQTPYLPETEYFEGKDDVEIDKIYINYNMKIAEEIAPYCQHDSNLCLFLWEKYNIKYKINAAS
FLYKLSQDKVLFYATTTSGPILEYMKSKKLYLERCVVKKYQGATVFEPDEKIISAPVLVFDYNSLYP

NSCIFGNLSPETLVCHVYITDSVKLIWCMKLLKEIYTWPDIYVNCVSVTGKISEILVYDRREIGIIPSL
LKEFISLRKDYKKMKTCPD-

DYFLYDNLQLVTKLSANSIYGLLTNEFVLKSIHSAKACTSIGRDMQLYLDVFKSSEFKEDGLLTNIQI

WKNEPLKRFYPSQTKLQCIKRVYGDTSIFTKLLFDLTLTASKIGKFFEDTINKEILFDQFVVEFEYILIN
VIMFSKKKYYGKEYNSDYENDPEISGKG--
YKKRDMCDYYLDLSKQVDIKIKTLIKQNPVNVLRRHVQVFLLAEFKLLTGKETKVEFYFTRRYGADTEK
GENPNSLIKEWKSNPNTVMIGERYYYTYVCDRENWQTNVKNKRMYEYILENSQKIPSNRIFYEIIILSRV
CDRVFKSFDDQAFIGFSSKLFGTKSKLYNMRCGKLAKNYIDLISKNTFEKGILTWAENPIILTKVRPDI
SIVIPLGYWSNP--
ILKNIDYNMMLIPDLKEIELRDQVTPYSIITIDKKEESRPCFLRLIMPCGFGKTMMAVKLIQELKIKTAV
ILWCTSLMQWMESLKFGGITDVVGSQGIPTLELINLKYPDIIIIITAAHLVRRDCRKLIQSKYDMIFIDE
SHKYNLNNVNLKFLHFYPCPFTFFLTATPRINSFYCNDILSFCKDNKILKRYVLSVSM-----
SEQTKKIYEGYDVKDRYKMMRGMVLEKDYRLEYIETVDFADDMFDGIVLTKSRNVMKLFNSLLEEF-
PEHVYVADAEEKETQVLLQYLKKKKCFILVSTFYAGTGLDLPNLDAVFFSSPMISRTDVIQSAGRVSRFN
KKPIRLAVVFNSSILNWINIM-
RKGSKLVTESSLDWVEDIVMTTSEFDRNLLKAPFRAAFLGSSGTGKTTYLFSLFDTDINHFNYYCVS
TELNFYSSHIWPKFIALSLSGKDMGVSVLQSIKRYIESEKNTKILIIFDDCDSILTKNEGKFTLTRC
RHVNISIIIVLIQDLTQIPPMWRNQLSHLFFFQVSEKSRKIITGQSVCSQLRMIATIDPGHSGKSPLVLV
KDNSKAVFKDRANHDTVKGKDFLFYSRSQKQKFFEWYKTSIIHPQLVILTGPDKVIEKILYLSHFKSI
NKTSNVFYQILKNKVIPEPEHVNNHVFLTLNNAQIRYYLMNLLKIDTPIIVYNNRYNIDYSYVDRQVFN
YINIT-KTGLQKNDLLYKLYPCYDNLILWVVRSSDINDNDLGQ-TGISWNM-
EHEHSLFECVKKVIPDFTITSFVNNQFRTEITNKTSKIQKYAESLPTPISNFFVTDKENIITGNRLDCQK
ELTIQVFE-DGILGIVIVESMIYIKNKSLFQEIY--
IYDYRRVTSEVVKVSLGSPINSSLPLGTDVNFLEKSTNNIILTPDKKTNIIIAKNLITIKMKNFYKS
LEKYFTMMIVSYNHIHSPNFKSNPFLGLKPYWSRICQNTIGKNRKLISSEISEQLIEQGTGFFKNKSS
DFYVDEYTNVYKCPDNDAIRYLGLKIFASINGKCIPCCFIQDQSSTPIYKCIDKVDTKKAYDLYILQY
GKYILPDKIGFLKSRMDTLMNTKSKLVEEETRRIKEANDYSVIVTGKDNHMHMINKDEEIQKYITDNKVV
LMYKSKLIYPENYHSLPSYKVLIKSLLHNIRIKKSNDSIEVESKRKIIADNNPFISEPIIKSHGMELKF
GKFYVDGVLFSHSISSDYINIEEKNTNVKTAKKFFRHHFSCVETLQEVFMTTFLTNIFQFKIPNSIEHSE
TKNLEKYFSFILDYKCECNINSVLNCDGKLCISCEKTFVDGKETTNSCYVGNKFIHFKNVIKRLLTR
SDNSDLVEELKVELKEMDIDIKDVSNSFISKRLKNKKIYTYKKVFEILSDLNNHHIDMSEEMFEQITSIF
HSLVLFVQTIIRSGKSINYNFFLNKIFMSVNAISYLHPQMVKPNPYRNNENQLWDMFIKYLKKKEDRTIPE
RSEITFNFYF-
ECSLNVSCSEVEWSMFPNQITIFQTDVTEVFKSLWKPEHLLISVWRLFWSGVKGYSVKKTACVSLSD
---TSVPMML--
STRHWVDKDGIIFFPEVASALYFKEVNWEDVGMHWFVGVRAASDLGILTSPSKTSLVKILGSTGIKVP
KGLTEPIQKLIFESWTKKFMVLGGTGVGKTSQIPKILFWFNFLFGPRDNICWSPALQSRPLCLALPRV
ELVKQVSSTLLKGLGLSIFEGSPIIPKFGGVQDDPVNTTKCNYGIEICTHRIAIAKNIRRYESMIVDEIHE
HDQYADILIAVLKKYKN-SLQTLMSATIDDDRERLNEFL-
NPQFVHIEGKSLHKVEEIHRTTDESKKYFKNEEKIMETIKFPAGHCGILFARVAQCNMKELLEPM
FPIEFIVVHGRVPDVLNLINKISGPHKQILISTPYLESSITIPNATVVYDTGRYWRLLSGGSESPV
GMADQRKGRVGRVIPGMYVKLYN-KYEHWKKIDGEFLYPYILLTYPYKLEV-
DDLIIKLDQGRWELTKNYLES-
FPIDRITNIYDKFQCNMIEFIKIYRDLNEKFGNWDTKPDISPKFKLLKLNLRVSVISCTNPLENRI
MRLKFGPEKNINETISQTELKQTLHKIHNSIFV--
MDKKIGYLFKPDPKGVFYRPLDFQYKSYRNFLFRINEILEIDRELHSDKTGDVKMFLKIYNIKTFPT
NTMTLHALKNKGYTCSVKFNIMLYSKTRTDSGIKEAIIINYTGFNDNMINVPLMVGYGLGDVFGSGAIL
PNEIGGTFLNYRSIEKIGINLLEKTTAWPKFKVKAGQYAFSFSISSPPHITPPVYRYFKIVLDFNNPEF
VISSQKMFITVNILILIKYLLKCNMEFIRDELLNGLDPVNDYFLHNVVNKIQNIVTTVRSVVKEFINFLV
EKEYNDSRSKLTLEKFNMFNFLPHINDDVSKGLYLLLVKMFLLFAIKPHEYPDRDSSHATRRIFTY
GSYFEQVTIDELENFVTKIKN-----
AGSTVNHMSMTTMGFNSAFNNLLSGRFRKTI SPHRTHVHYSWMQNVVIPRSIGFYDPQVKIAKIFNCRQF
HPSQYGGFCPTDIPDHGESVGLVIQLALHSYITSIKLQEQYKQIRNEIIREIKNITSAQMMRFKTVIMIE

NKIIICSVAPDLAIKIVEVIRNIKRGMFVNDFGVTYIQGYIRQIKFNIAGRVVPRLLVIDNGELVMEKY
RDEIEAF--
DGTWSELLETFGVIEIIDIEQFIYSNIIENQKVYEGMSLEQRKLYQYCDFPEEFRNGYSASCLLGINHN
AGPRAIFGCAQVKQISISCLTSDILNKIDNGLHMIYPEKPLVSMGIITSLISNTFGQHINVALTSCGMN
QEDAIVCROGFLDNHGMNILSTKKTQLDIPNENFRASQP--
DYTYGKLNHLGVPVINSILEAGDAMCKNV SIRVIDNSKEAIKSDISEGYTDIYPGRTVRVQIENS DKVKV
RLLTVSERQPIMGDKFTSRTSQKGTIAKILPDHEMPYMEDGTPDFIINSTSIYSRKT LAM LLEMILTNV
FTHKPI NEQGVRYVNFPSFNVALESYDFGSTCIKTAHPDWTPEQVND E L FCEQTL YNPDTHEPYKSK
FMVGM LYYLRHRMILDKAAIRSRGKKT LTKQPN EGRKRGGGIRFGEMERDCLIGHGAAFTLREILHDS
EEDRQKAKMCNECGDFLMLSKTESYCSRCDIAKLHPYTEADLSHVVKVFKTQLGAQGIKMLLKESETPSV
YYTKP--
MRPITSIEFGLYTNDEIERSEISIKNSKSANDHETVKDKRLGTVDN LCKTCRCISTLCLGHWGKVG IKN
VYI-
RPSHV NQIIQISNYLCLHCGVFKLKSAYTSTKIALKHIKELAKSILDKSGICWNESCQQKYVKISFNKKK
ICFTWKSKEYPLQKLFEMFKSIPALYPMIGVKVSPENLFYEKNIP PMLIRPPNSFWLDDVKKETHEL
TILMTTLINQIKSNSDSMIIQKALIEYDNSNILAVKQNNNSLV SILVGKNM L RWHILSGRKDQTCRTVV
GPDSQLLLWEIGV PDMVLSKLSKIFVNPFSIEKIVNLFAGQVKIYFNKQTNRLMTLKKDKKLKGQVTFK
PGDW EIDLQEGDHMIFGRQPSLHRHNVISSCIKRVEGCGLKIPQVICNSQNA DFDGDEIWGCLEQHPKA
TIEQSILMFPVTIILHDLLGIPLYGNIQDEIISAHLLGTTELTLTEVNYL FKQCPHQLALPGQKYFTGKN
VLSIVFNQNL TLP GILKDGQIIIDNIGSDLIVGQKTSLSKLI IETSSRLEGCKFINDIGRLLRQYLRFRQ
YGVIFTDLPDYAYVRTLN NNDKLFKIKSNFARYIRDCEGKIIRLDEQ TENKYIDTVLMSLVKSNICSI
TKFIETQLEINPRNSLYVMSKAGYKMNPT EMMYIFGTFGQKIGGKKMSTGVNSRILPYHLPGLDPECR
GFVLNPLL VGLTGIEYYFTMATARSQIVDIVCETSRTGSLARKILK KMEDVVVNELGYVICNKNILKFAC
NDIKMSKQD TTKIPIITPKPSQKWYSEIKHIWNTLAPYL TTDNKRNKITQCSFMLNLD MFLQTKSRVPVE
SNTL FKQVNEWVDMITQKYFFNLSDTTMIRY TMLTYLDPSRYPIDSVVLNDL FENIENRFIYSLSSGYPV
GVIFAQTLSEKFTQ QALS NFHTTAKSGGVATLGFDKFLKLVSLTKTKAEVITFTSKT PLEILQNNFQFVC
LDQLCPVIKTRVENTKMY-
IEMFDRKHLKSENIQIPQLEIMIETFFNKIQITGQWSYWTEILDKRKFIIRITELEEPVSVNQYILP MML
PGGIYK GKICDVKFPIEYSEHDEHKQVDYKLIMILDSTAMLT KFDLSGIDVPGI WTSYFGFGIESVRNKL
INEMLETYGN GFDYLYQCCNLLADVMCHYYY PETANNFKMTKISIMKKMASGDYK SVAQA AVSGAVDVVQ
DNSTCHFLCQPIKVG TGFDDYYTDINDF--
VAKSTIEDIKETLLIGFMNTGSEIVA EYGKMYEKINMDLEITELEFTQFDPSLLSLSKMFNIKPLTDSY
LEYILDEGN NIKIRIRIDFAVVGLELNNQLLDYVEHGCWESKETKDIWLSPEGRITSATEKQGTYINK
VIQSGKINMIFVNARVKFSD FVDFKLKRKLGNCRQGN S NLYKSVNNAMYPPNPSLEIEHTQFKKPWKDV
KLEFTKVISWIIGHPIEEILTTPFKI IPTSVITPAYLMSIDPTQHKLTPKINGV VFKIDKKHVLVQQMLV
ISIWRYKHLLTVTEDIGSGEFIDDHKCIYPYMI-----
LGHDVSTKWEVQDCANLYDHVLIKKQWTGPFNDITDMLTAIYEMTVSKTDGLILSYRHG---
KDYKIKATSDIDIVGKVRFTYSDPRQMATDGMILTVDYMSNATNELVKIRIKLSPEFDYLNDFCVKTTR
VDPQVKLSHAVVPIGFICEYDVRTKEIMIRLTKSSTHLWTKYLGNNWTTIQTHLLSKEARDHTVLQDVKI
NGTKSMEDDGLRLNP KTTYFKENRIRSPLGYISNFVKSLLISLYASKMFYSNSKKARVCSIDFGNGADLT
KYFYAGIQLIATDPDSAAIDTAH DRYMKNKNEKS NYRFNYLKTSIRNENFVSVIRTVTDQLNFDVIDW
QFAAHFSWNHKKHIQNI MHSLCEITKPGGRVLITTMNGKGL ESILDKDSDVTFKIPEPTGYTTITKTSPTT
FSVLTPLTTTTAMTEYIIDPDQM IKTFYDYGFVLLDQGRFDEVFNINVPFFAGS LLETRPSTASFFAQQR
GVVHIKNTQLDQLLKYIYMVFQRG-----
METDKLILPNHHKYIHS DILYNND SKTCLTCGNDIGVYKLETLFEGIGAF CSPACSDIMAGCVSHISLKS
PSRMKLPPLCMYKNSTRLVETVT-KEME KCYG-TQQRVGNMVRVLIKKLN
>Canvi
MNNSILSVNSAD-FMKRTNIFSF DVQQPTAYMPQYISVNG-
YYDTISFDIRDQHISAVNYFVLSIELPEVSGEGEFAYVPYVGYKCIQRVIITCGDITI WEDGEELFDKCV
DDDI AI-

MSGYSSELNDVSI GYTPNDTIKEHTTVYVYIKSPFDIDKTISS LKLVNSKITVTVTFRSINDVIVYDSKF
QAEKFIQEFVYSPELHLIAYAVNDIKPKSAYIEMDRRLVSSTPAPIPVISDVYACSEVSVYVKPYYGNKF
ISYPGFKQNESDYIQSLVNRLLDDL VVVTDTPVKDFPDSAMFLKVPVKGITLQDVDIVVKIDNVPEDKDV
YYHSNLLVFSTRKNSFVYNISSKFSIIGTYSLITDSINFSNVVHSISITDASIPVSFWSSQKNVYPGDNR
SSHKS KDLVVNDPFRKGIDMVNKTEVISRLELKF GNDPIYTETLPITKIYNKLLTGTRVNM RKLI FNMN
PNI FRPTTLNANTKRGKDKLTVRVS YVDIDPNNPIHYVAKQLVVIC TDLYRIDYDGKINVT KITEINNHI
VFVLKKIGVSTKRNNNDIRYVESFTCEELERYIAKNPGCTLFEALKNEEYSNIRVFFD VDMEGTLDDNS-

SAINDFMRVITKFIAYAFSCEKDKQMINMKENFSITESTNTEKTSFHLIFFNCYTTVDTLINMGKLLP
LIKQSNRLIKAIDTAVYRHNP SLRVVGT RKTDPNVYVHKTDNRVPFKNYLFTYVDFKDD-
CYYFVESYN SPDLWRDEYIPFDAMKKVCKVINNINLKEITENL TEIPLNINYATPCNLCKKVSHKHPHK
LLIDNDIRIIKCGNPNCKIKVILEGNKLF SISQIIDLNVINISDRGEYLIWLKDVWRMCEDES NITKL
ILYMKDYISSDCTLLLCPNRKVIEHNLK DMLIDPIETDIYPEKLQFTNGVYDIDS VFYQGNDAKNFVCT
VSTGKYED---

KEDNGVIEELSILDDIQPTKENSENRELYEQILSSCLMGTTKQCIFFFYGETATGKSTTKLLKSVMHNM
FLETGQVILTEQMDKGNPFIANMHLKRAVFCSELSCNTSKKIRSDNIKKLETPCIVGRPCYSNKINNRN
HATIIIDTNYKPVFDKVDNAIMRRIALVNFKTHFTSRKK-
VYNTKYDFIKPLNEGLDSKIQSNYFRYAF LKILLGWYQKYHVPLTILPTPDIPDFKFR LKIDALIIPSST
THIKIKELSKLGYIIDGLPLYVSFQQLQVYFNVKLYGHDI ESFIKKNKYNFTDEYMSFIFIEDLNNIMN
LILELFNGHIDNIPNILPHQLATLDYLLKTI LDQNESVLLFHIMGSGKTIIALLFALIVSKFKKVYILVP
NINILNIFTYNLDLATNLINTEYVIENIHIYSTINFYSLNNDNVINYNALTRYNDSIFIIDEAHNIFGN
NTGELMTI IKNKVKVPFLLLSGSPITNTPITLSNIISIMSDEGINFNDII IQGKKVFQIILNEKGVSVLK
KILKNKISYYELCDELPSIIFHGKEFLDTKV VYCRMSKLQEIDYINVRKLCNNEMFEKNMTNVS LAVLG
PLNLANNLDLLAEQDKELYPNLKINDGVLYGDELTKLNIS SKFRYFIDTVNLNGKHFYFSNSTYGG LVI
KYIMLNNGYSEYSGSQGTNPKTINGNLKTF AIVTSKMKASLEDLLEVYN SPNDNGEKIMFLFSSNIMSES
YTLKEVRHIWFMTIPDTFSQYNQILGRSIRKFSYKDVSKPVNVYLLATVYSDFNDKIKSLDDYNIDEINT
LPFDIKKLLYLKFKTKETKRIYSILKDISIYRSCPHYILDVVLGEMIRQYFYHHSRVS FDDQKLFKMIN
IFKCEKTMQYIKKITEDHFFITNKT FQKSLLYRHKNDIIVVPFSLVFKEYSWMINFRKELNVVMDIRC VN
WFENKGDIKYIYLKAITKDN GVI FIRFNYYYYYVYDSE--

EELKFKPRILGEFDI IKIDELDDD IENERKYS DLVVVDVKR-
SREKYLGEYLDITW FYILNNIVPDG CYRINDLKQIYTDCYHCDNVKMIIEEIPIFEVKFTY LFFDIECQF
DKKFP SVFVNPISHISCLIIDKKDEKFTLINTDLLPDE TISRKQFPRD-----

KITFCSEVIMLRIMKKILEERFDVVT FNGNNFDIRYISNRLTILEKSIFSLPDNTETTDLAIIGRFLGN
FTNKTYHINNNNGVMFFDLYTFIQKTERLDSYKLDNISKNI FNCNAIIDISDDITMAGNTKDKISIFSEV
LQTGN YITIGNSDIKIVYKDIRSDSFTIKVVS NKPYECGSIQFISFGKDDVDLRSMYANYNLDIALDMEK
YCIHDA CLCKYIWDYYKIPSKIDAASSTYMLPQKSALEYRASTLIKGPLL KLLLEEKVVYIREASKRPI
GGKVF LPSQKTFENVMIFDYN SLYPNVCIYANLSPEKLV CILLNSNKLES DINKMLKRKYPYDPYVCV
MCD SRIEGYSEIIVYDRRNKGIIPKLELFISKRKKYKSLLEATTIETTLYDSLQYIYKIIANSVYGLM
GFHSSSLYSYSSAKTCTTIGRNMITYLDSVINGAVWENDKLLADPNIFSDKSKEIEVP-

PMNETFFRNVYGD TDSIFTEISNRDVETIKIAKILENIINTKILHANFKIEFEAVYTQLILQSKKKYTTI
KYLADY PGDPIRVNKG TSETRRDVALFHKQMIQKYKDLLMKMLMEGKNQQDITRDILQHLEVMVEF-
SNNKEFTYLLSRKHNDYKSATHSNFLVKQYNL INTEKIEIGERYFYLYVCDITPWQKKLCNIQSYETIA
DSKYFLPSDRIFEVYFKRIASEV VNLTDKTQCLFFNRLFGTRPVFSSMSITVIDDKLYSSLRKLIGYS
PLYLFT EEGKFVEVVKNSEFKFLIPP GYFSNPNVPLNGFSHGTMKDKHTLPELYPQKRVIDEIQFSKKK
EKRP LYTTLHLACGFGKTITASYLIGIHKNAVISVPNKLILQWEAAIKALKVSYYISHEGVS KLLKVLS
SESFSILVVVDKHTNEEFCKYVYENYDVFILDEAHVYNLMNESTMTSFLCYPPRICYFLTATPRQNAI
YCNSIINFIKFSPLQKVLHIIKEFYNEYTSPTIKNYISQLQPSNKYHLYTEKILAEDHRNKTITDKIEFR
SNNGNRILVITKLRNHMFIYNSLHPVL-

GNCVYIGDAQKKDTTEMIKELRTL DKFILVSTLYAGTGLDIPNLDSL FICNTVMNSMQTEQVMGRICRET
SSPTRSIFL FITSIKDIKSLVGVFTQRFAQQATK-

LGFREITIVREVKFNRTSLLSYFRMVILGGSGSGKTTYLLSLFKTFVNKYKHIFLFTPLINPSYNYVWP
DHVYKIADNELEYALMMRDDL TNLEKSSNHDFLIILDDLGAQLKSKILPWL VNTGRHIRMSIVMICQT
YRHVPTNCRSSITHLCCCNVSDADVENITRSM SLLTTKPIIRALSVMRAKGKVKYI IENTDVRICYDTAD
KAVINKNDSILLKQFSHMKRQLSIEE-
YVVPQLVILVDRDQKIVDVLYLTLYDGI DRRSSMSYFIRNHLQLDRVRLNRHIIL TLKISQLKGYLCN
LLNIDEEIIIYSHKNNLEYSYVDNTTFNPFTMTQRKTLKSEFLYNVYIDACNFLVIWVKASDTNVRE
LGSYEEVD TNVLKFESKLIEMFNLDLNF TVESKFNNIFRTNLKTGLRNLVLNDD-----
KKLFIKSDEYFILSGNHFVLNDEINLSIWDD DGLAISDGN TITVNNVKLFTDMIPNNVQMERIKSDIT
YKVSLATPITSKVLDIETSFIETATNNILL SVDKKISII LAKNHISIKVKNYIPNIEKYFTFMVIFI
NRLFNTVKQSMDFTKIETIYWSRICQNTKDKNRKPVIVSSLES DMVKISDNFYKSPTKEVFVNNNDIMFT
CDKTGKYNVGF LAIFYKLQKICIPCCFLKSQSHTDTFMACVHNKETDKSISPYILNYGKVVTDSKISFL
PPIFNEFFNSDMKIDLES DNKRLRGTKGYHVIR SCLHTLRIRSKNDIIEFVNSENVTLIANDIVYFPMK
YSSIGKIFILVQEI VHEIVVKEEDKDIYLELKV NKLKDI FPYIKVDIKEENGLKLT TDGFCVDGEPFTE
PLSTKCSVFM DNISINNPIAKYFNQIFKYVVT DNEMFIKTWVINTMLMGISKDWNSSQVKTLEKYYK--
RNLKCSNCKHNGLITEYNHEFCIFCQSVFQLSNKVKKS NFHVS NKLIHLRNLRRLLSNQCSSD VITELR
TVMNKNNIS SKDIDANFVSSFLKANDKINYKLVFEI INHIKEEKLNLDTNKINEVIEIFKHLVFFCQENT
SSKTINYSFFLDKIFNLTSVTSNLKPQTVKNYTKNNS NQLWENFLEYMKNKKINTVDYGHEYVFDYFTT
CSLEVTNELFSIYAFPNMYDIFPHSYTYKELEEYHNKDTFSHSVFP IIKHRWNKVFI CLKDDTYMLNIEN
SIAKIPVSKPINSQVYYIGNDRFITFECYSYVKCIYNHVSDITLDDKRGLLVAGNHL SIFS NKVVKNSIG
ILNPNPFIISFKLSLTTQVHIFDMLK KRKQIVVTGSTGIGKTSQLPKVIMWYNYLFGGWDDIDIRLDFI
PKPIVLSLPRVTLVKSNGN NFLQSLGFSQFEGSPVELKYGGHTE---
KTKKGFQGI VLVSTNKLTSYSLSKYNIVIIDEIHEHDRIADIMIAVLRKNDSIHSVLVMSATLEDDKDRM
EFLPDVEFYHIEGPVLYSIKEIYVKNRSPDKVYFDNERKNISSTLLCKPDGMCGILFLPSVSEC IYKEY
LESKNKIDFIVIHGKLNIAEILQDVQNRERPCILVSTPYLESSITIRTATHVYDTGRVYVPRPFGGEQM
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RSL

>Nilcr

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>Vacvi

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PTLP-

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FIK TWMINIMIN-----

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RK-

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>Yabdi

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>Amsmo

MKRTFI--

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-

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GKKKGGGIGIGEMESDVFATNGSVYAIHELQSDPDEFYLPAHICGNGCIFATYEENIEVCLQCENLGLSP
IIKMRLTYATKIFITLLNARGISLIPVKDNQSIRYISDDNT---
MTTFKYTLLDNSTIDAIPVIDSIGNDNE-
NSVKSPKLGKTFNVCSTCNLTRENGMHPGRTPLRDMCIVKSGCIKNVLDLNTLCNSCFMIKNNTIFS
EIEKYNENINLKEILSGGVKCNNENCQNTITGTYKYNKKSIFYVKKQKDILNKTVYTMLLGIPDIIYPY
ADSQLQPYKAFYANNIIIPVLPSPRPNYF--DN--
KESHVMTTKLQGLVGTSSQSRDESEVQKIYNDIDNVKPNPYKTSNVTLNIQVGGKGSIVRSNIMARRADN
TARCVAGPTMD-
KIGYIYIPKIVAKTLTSSIIYNRFTENMIKMLNDNIKYILLRYDQLLKIKPQSRLNLLKMKYGDRIE
VELEDNDVILFSRQPSLHKFNIIQAGICKIWDNNTIATPTPIANSMLDYDGDENNVYKLSVSS-
VESLFTMLSVNMKNYNSPFIQGLIQDQIISVHMIYNKEFSLQDVIYILGEYSY-
YIRDNKKTYSGKELLSLLFPDNLTYEGMFDNGKITLSNISSKQVVAQSYSFSNLSQLKNNIYAVYFIDV
ILYVARNFINLYSFSVSLKDIPDIYFIDDVQEYINCKKVIQYVALQYY--IKKDHIKLT----
YDEMENIRIQNGNIIISNVKNKINLKFDEKLNTIMMMKNSGYKITLDELVTVLGCTGQQGIDSDDIKPG
IMGRVFDSTLPGSLDIESLGYVKSSTIKGLKFEELAFHTYNSIKKILKITCETSSAGSIGRKLKVFMEGV
KVDHLGRSVLNNDIIWYNTNHKMTGGDISKVEILTPSLEMVNYTLIKEIYNENKKYLLTNFNTEINKEF
IFPINIKLEIQSYNKKPISDIDALKLIDEFIEYVYINIYFYINITIDWFKYILYTYLDRNTVKYSKELLY
IINKIKLKLNSLNPGYPIGLEYANNIQEKFTQQLSSFHHTKSGTASQLGFSDFKDVELSKNKRDIV
IAFTTHKLEDIKQMEYLCLKNFNPKINIIEEESDMV-ISVIKKYYIN-
DKISLYHYLQMYIEYLENNKIIGY--
WITMLKDNDITVIFVKIKTPYNINKIYMIKSIPVSVSKGKISNINLEIDVKYNNNLEEQNYRLKFYIDSV
TDFINFDRDLYLLGPWFTYNSFGIQAFAEYSIRRRLVSSTKE--
KSMEICYIILSKLMCLSEMNIKRIREGKQNVIKSAIHGSSDAITTAAYNNIIDPNNDIYSQILSSQIM
KLGHGYYDCYLNLRYSINNSVTEQDINITSIENFMSDVSDIINDCIKFYSNISNPNVNEIEFTYINP
DLRILSNIYNNESKKKTYLEYVLNKKSKLRQKYKYDYPT---FEIANSYFLDKL-
TNNWERKTIISEDKINEILLRHNTEDNDIELPLNDIDKINLVFVSLYIIINDLIVEFKIKSNIGPLSSN
KSTHFNDIETYRKNITYYLEIEVLKTKLDNNVLYDNLVKSFEYIYKSKNISNISLINKPKIKTHMIQYNK
LTIDKESYIMAIKIDGDVFNVMNG--
ICNIIIDYDMVYKFCNIDKNIQMGMEYIKDNKKIYPFYFSKLNNKIILDYKQQYYNDNLLCHPNMQIK
FNKLTCLKFDENNVTNVLKFKYSIEYDGVLLDITDNDSDYKFKIDNTVDVICKLTYR-
GTYLHNDNKLYITFTLYQDNKNFTEILKYEEKNEIEYNNYVNLIFNNNK-
FGPKMLSPIWCIVEYSFESKIIGLRIDKTNFYRQNYNGNLDVILTHIHEENYNDYLSLNETINVI
DNPRSKLLLNEVNYFMNNTIRTSINILTNLYLKTNGISMAISKLVTTLPN-

RYVLSIDIGRGGDLTKYYYVGITMLGTDPDIFAIKEARDRYKKLQTISSNAQAYKFDSLNMISLNDNYENE
IKNKFMTTHFGVIEWQLAIHYSYNNNTKDMILLKLNLSNDGTVIITCLDGDEITNRLNENPNLIYNI-
QPGITYKISKISDDKISVLYNATMTEWLEEYII-
TDKIIDDFAMYNFILSDVCKFDDIFKYNSDKSEVLSNFLRKSTKKFYNDIKNDKNYNNDDIKKIMSLFKV
YTFVYSFKTDLTNEEVSEAAKLIKNTDLTNNCIFSKYKNIYTEFKLINSKSNNCIYCYSTNIKIILEHNN
GIKG-
FCSIVCRDSISKQIYNIMPIYKFSAYLVPFELIKNKKEFLNNINIKNIDNLYGGCHLTNNKKVELFITN-
-

>Anocu

MQRSLI--

NYNKINSNRSNIVTETRDGNYNIPQEFNCPCSIENYYICKITDNKLEGCNFGLTITLPEIKGIGTVRY
QTNFVYKLIIEFIIETIDNIIILKTGLELDFDIKQEHNYINIIGNNQNYCIFKTGKFSDDIIFNTCEIYIP
LITIFDMSNPRTCLRLPETKLQIRIKFRPFKDILIIYDIKYRKNLSIQDVLQPYIKFLGYNTCSDEFNR
YIEELVTSTHQSNKKNYTPEFSSITNILWYTKSFNNKQFISYPNYPETEESFIDSYVNRILEDLIIVDC
NKKRQFSETCKFLKLSDEISFDNNVCIINITNIPEGYDVYHTNLSFNRRNSTNEYNISKKFKILGEY
LLEDRIIFRDIKHNITIHDSIPIEIWNAEENTSTKDLRSKKSQKDIINDPYIFGLDLLSKSGIFTR
SLKSSNETILAYFNCNLYTTITNSSYPSIFLYRFNIHNLFAEPSRLADIEKNFRCVNITIDWKEFP
DMDPRSLFPKLIICITPIKKIYDNNIITQILDKNKI-

YLQSGLCVSKEKYNMNIETSNVFSLNKIKDVEDNPLPEYHEFILEDNDYFKLFIDIDIDKKFNQTYVY
KSIIIEFKEELINYFESCFQYDETKFELHNIHDNIYFTISNPNKISIHVFFDNIYVNENSFSLKNNIKI
LKNNSNISLIKIDINPFRKNTQLRFIYSRKS-DSIYYHIYENDDDLKHLYFTYVDESPLHIKLLASIN-
YDDIYPQNFLSSEKFIYLADEDNIIKKLCKIKGYTMDLNLDMLY-K-C-

YCLKDKHKHNHYLLFNAEILLKRGKINSCLPKIFYPRLTSYEISKFIVSLDIIKKINNDIYVFDNKKW
SKLDDENIYAGLALILCEHFDDVNDYIANRYFKEAKNTIKSHLLGYNDLCNNPYIIQFRNGVYDINSKF
YKGNDAKKYIKLSYINIDYKDNMESEQSFTKNYNLKNIIINLIPVDHKLHRVFEANLSSILLAYYKQVIT
IFYGDTNSGKSTIKELIRSLSTMFIEIPIDNYTYEVHKGPDALGKVVDDKLVSFASE--

ADYNETFKLSLIKRMTEPYILARDLRNNKCDQLNTLQFIDMNHKPKFDGIDTAIFKRIAIININTTYFD
ENLFIIERASNIIKRDNMLWNRIINKDFTLPLFYLLRCWVLKYHMAINLLSTPEIYNDEKDNNTTKFC
SGWGLKKQIRANARDYYDEIDIYIPIPLRLRNEKSQYIDVKGHTPVLVVDHVYHPNCQWYKYKYSEIWD
RLMNKILDDLKVPANIPQILPHQLATLDYLYKTCVENNKSULLFHKMGSGKTMISLLFAIICNIKKIL
IVLPNSSILDMWKSNI FDAIKLLMKEYLLENIEFTTRTNILGVGQNIETIENKIQYNNYIMIIDEAHN
FFGNITGKVLINIRKKTNIYVLLLTGSPITNTVTTLKDIVELLAKENFDNFKYIQVGNKVFESKINSKGI
EFLNTHLSGLISYYDEERKDLQVVFVKGKIFLYPLVLCPMSELHEKNYNEIADVTEENEMFIKLLMNVSF
VALGPKDNYIHFKEI--

SDQQIFDNLYISNGRFYGSELIDLNISSKLKTFRDTIKERGKRFIYFANSTIGSAIIRSVMRANGISEYG
KEILNNTYTCVCITDKKFIITSKNNNYINNLSIFNEDNDEGHNILLFGSKIISEAYTLKNVKDIWFLT
VPETKSEFDQCIARAVRTFSYKDLNIKVTVRVATLSNTLISDISKTIEQYRYELTDLSDYFRKQLYSEL
KFEKSKVADNIFKKNLVITDKINNIVFEFCIIEKIRRFCYTNNRFKYNDNFLSKDIDNNIYDEILHNTNE
AIENHLIIYNNVFGICYLDKYNDIIVTIPVILDYNEYLYSVRL-----

IDIKIFNWTYVKNRLEEYIVCKAKDQEIIYFIFDLNYFLCSEDDVDNNEYLKKNIIIEFKIISNEVIQY
NFRHKDKIKNLYLFRFKIRVHSYNHNFNFYRWVYVLDINPAGSYKINKCKEFNVKTYCDDPKLFSNK
ISDKFLPVSRLSFDIECKHNGIFPKPETCPIHSI-CWYDDGSSIKFILINTNIILD-

NYVKFDDFINDINNNVYNYIYATEQVILEFMIYFLQDFDYILSYNGHNFIDIPYIQGRLNYYRGNLTQN
IMGVNNLLINQKITNLKTIQDIRHDIASNNATTYLDIYNYVKEFYKLPYKLDIAKYKFNINAKTTDGG
ITVYESSNIKKEMFYKVLRTANYCFINDKAFIYDKKNIINNESSIKKSIGKEFKISNNVEITLSKDDVE
IWDAYKNYKLSKAKDIAFYCVHDTILCNKLFEDMIDYKIAAFSQLYLLPQNKSLLYRNSTNSLGQILYT
LLKNKMMIVTGHVDDKYEGAMVYDPKKKYVSNPTLIFDFKSLYPTAIEGNLSPEKIEKVIISDDEIANT
YIDTYLADTYKYPKYLYIKIKSNINNIYTYIVTDKSSPGLISIIILMKGLDERNKYKQLKSENNNILCNLY
DNMQYGIKIINSIYGLLSNQFIFRSKYCAQYCTALSKKSIMYIHEILDKSIYKSNILINSCNIIFTQKL
IKTKYEGNINEDFIDIVYGD TDSL FMSIIFNKIRAIDIGNFLSNIINNDIFPDIFEFEFEDVNCWIVFTS

KKKYDDIGLKKIKDIILNFINKGTLLVRRDYCKFHKDITYKNIVDIIKCGLKSN---
KNVELEIENYVINVIDTLANRNLNIDFVKMTYSGKYKDKNNIIDIVKNYNRNNPNKIMKGNRFSFVYGT
EISSWNFKTNDINQKIIIIIGDDIKYDNIRICIEKYIINLLNNINMLLNKNIIINIKDK---YKKN---
NLYKHMNDKLYGLFYEKLKTQHILCYDSNNPYFLNKENKNINIIIPPSIISDLNLQIHN--LNNDIN-
KNSNIILRDQRIIVTKI--
EELSNFIPVYVLLCEPCGYGKTIISIELICRLKLCIAIVVPRKFIIQWKDKFNTNTFNIFTSFNGRVDAI
KNITNGDCDIFICPDKHLENDTIRNFIYTYFNFIIDEIHKYDLNKDIAMTKFLYGYFKLVLLLTATPK
NINLIINNKKIKINKIDQIKKEIYSFEKINDSNITSECKKFLSKIN-
LNKYNLYTKNCISLDMRNNITITQIIQINDTT--KAILLTDYRNHMHLYTLLKSEL-TDIIYIYDVKD-
NKYNLFSELECKNKFIISTACSESLDLTNLNTIYLVLPITNKNLSLIQCTGRIMRTS-
NENKYIYLFNSYLNDIIRTFINDKCNFVKRILNN--
WEYNINMIIIEKIDYDKIISPFPMAILGKTGSGKTTFLKNFLIETREKFDYIYLVTRSKTCYHHYIYPNH
VLYLDQDDIKAKLSFLDNIKKFSFCLEQNDTLVIFDDVGRE--
TKDKLSNFTNECRHSRISNIFLVHRLEHIDKTRDSISLYV-INSFNINLEYLEINKSIK-
TMINTSILNAFSYKERGLFLIIQ-DSKVYSLVINDSTIKTNEANVLYTNSIIKQYI-----
MYILQPQVIFLDFEYKHKVRTIFLSNNRLIDNSNVMYYLNSRNTKLALPEYINDHIIILSFGLDARGYIK
NILSIEEDIILFSIFNNFDYYPDNTIFDPYNIPTLLIQTNPVKLYSIDINIVNVFCVTTNEYSKTNLA
RPSIYIDIINNIYKNNYSLSAIIKD-SMEYSLNNTYKDLIK-----
LSNLDNYKITYCISSNFYIKGTKITL---
EGLNMEDYHVLIIYDEKLNPIYIQLENDVLAVTKISDFINILKEDINIKSLNPKTIYIYFNTYLNPNLTI
QFDIKFFINQTKTRNIFIDLSNKINIMTSKDHISFRSYSINSDLCKYLTLILGYSHIFNKIQHGRIKK
VNELYPVRYCQNYKEIKRQPILINVENKELIKISDNFYIGKEDDVYIDENGLIYQCSIY--
YSNMGFLGNIYSASGICYCCYSKPKTNDPTFLTCVHGKMIIEINPIIINYGRILSTHGISNLSPKLNS
ILNKNSSIEIVKHTNRIISANNYTIITSYQ-
PSTSIKDFKELYNFILINNAIINENTINTHKNILNTNKVFILIQNRIHQLKINKAIKSDINMDIKIRIL
LNYFNVSNKTPISDNGITIKNDICYIDDIPVNNKNIKYFTEFTNVSLPKPKSTSEYFNNDYLNNISSDNLF
TKIFVTKIMYINIKTDFTSKNKLDISLNYNIN--
MDCKYCNSFYINKNNDLYFCDDCSSYTTTTSKRSIKSKPYNNKKIHFSNVIREISHNNISDINHNDFEKM
LEDNNIDKKSITSTLVYEFKTRGKIKNYRQTYSLMMSKGDNIILNNDDISKIYIMFDDFIKYLKCKQI
RTIDYGFYLNKIFDILKLTNNLKPNTFKSNKRNNKSELWNNYIINLNCRSIDII-
FPNPIINDYIKPYSFRSMNNLSNIYLYPNNTIIFQTEIERTYVVKYDPN--
FIILVFPVFKLYWSNVFLCLNNNKIYLDKD-
TKLTLYEMNSIFNIIIEPYNLYLTYSAYAYSTVLNNKFKLLNIHQLYGIVDDANKLGILS-----
NSSVKSINSFTFKSDLRSTQIDVQLKVFDFIKRDNICVSGGTGIGKTTIIPKLFWFNFLFDGFSEFEF
DTDIIKKKTVLSLPRKALIRSMGMTYINSLGYKDIINGAPINLRYKDVKLEKQNSTNNFISFTLSVNRITL
NIIKNTNTILIDEMHEHDKFGDITIAVCNKKNKIRNIILISATIEFEIDNVKRFKINQIYIPGKSLYP
VNEL-----
EIIINVILNIIRNLPNGYTIIFFETISKINEQYKYILNLSCKLYKIHSKIENINEIINKIENKHYIHI
ILSTNYLESSITISNAKVVIDNGLMYLKEFLTGKITYITESMSRQRKGRVGRMSPGTYIRLYQYKLNLLK
FINHQYLWDYIIIFKYGLDLKKDYFVIPDDLTRVDNTINYLLKKQIDINNIIFRLYNKIELRMIEYLSVY
LNYDNKILENFIKNIIEISYELTLLLKSLNVQCKLVRKRKYNDY-
VCKFILLDAYDGIYFNMYNINDDNIYYIICEDPFKIRIEDNIAKLYLNNDRLNIKSKALINTEL PFRNL-
MHDIPILFNREEIIRLTKSTTENIVMKLEYIGKEENKKSFLYSSFEGKSFDMNISIAVSMIKRITSKTGI
ED-
ELIFRNEYPHQEIRIPQYVSYGGNII EYDNSITQTNNSGGFFILSKGLMKFVTLRIEQTSVYLKRKSKP
FVFHASVSKLSSFEMPPQYL TIDLNPNKIKCITDSKKS FIEVDIILLIKLLSGWEFDKLTAIITSKF
DDDIRDKINIIINNAKNILQEFNNNINDYITYEVKRSYNKKKDSPTLQEFNYCFSNFLPHMKYGRLLQS
MYLISIFRQFMISIFQPEIYPDKDNLVTRRISTAADIFESIIRNAIDISFQQAKEKKSSEDITIQNINNI
SQFKIVPQITSSFNFFNMQDTKNSDVVKTSMHYNWQEPPIIVSGAVGS---
SIELTKSLAARHLHESSITVDFMFDTPDHGPNTGLIKRLSIGTLISHYTINIRKQIFDEVYEFIKSNVVK

NLIDEINGVISIIDEYITSIKESVHNFIKKIKETKRGLFIVRDIGIEIIRDTIMQIRINVGKRAIEPV
FVVEDGKLNIRKYKNLNEELNNYDSFTNLIINYPDIIIEYIDVGQSIYSNICNSVIEFDKYDIDQKKY
VRLPNYLFFSYLTSMDYIGKMTGVRGTFGAAQHKKHITGPQDNVNLKYDSCNYLAPQRPCITTIPMEI
SGIANGIGQHTLVGFFSFN-
KNIEDGVILNKDSVDRGLLSVITLMPVKNEISDTQINNNPNPENSYSKISVSGLPEVGTVLVQGDALYR
CLKPKFKDGDNNYIFDQSEPYSSHYPVVERSKRGTDMIKIDILMSSFRKVEVGDKL-
AKSVQKVTIADIMESHMPYTEDGEVPDIIFNSTSIISRKTLPMYFDAMLNMYSIIPYNDGGEIEYINY
PTYTELTAEDLIIYITNQIKKKYPNIPDAMLNDIISRKTIIFNPYTHKPYKTKAFVSPILFCRLSQMSAD
KISVRNRGRLDKYGQPPS-
GKKKGGGKIGEMETDVFATHGAILTLNELLSDPDERYLPANICSNCGIFATYEEDIEICLQCENIGLSP
ILNIRMTYATKIFITILNMRGITLIPIKKKYDEIYLSQY---
MDYVNYKYSIISNEIIDAIPIIINSISNDSE-
NNVKSTKLGKTFNVCSTCTLTKENGMHGLGKTPLKNIMIIRPAFIKLIINFLNTICNNCKMIRNNIDIS
NVLNKYNKSPQLRREIQLGNLRCNPNPCGKTIGSYKYNSKQFFIRKTEDISNTQIYNLLKGIPDIIYNT
SESILTPYEVFFKNIPIMVLPARPPNY--DN--
KESHVMTTKLQGLVGSIIKFNTEDIQKIYNDIDHVKPKPKYKGNVTLNIQVSGKESIPRSNILARRSDN
TGRCVAGPSME-
KIGYINIPSLMAKTLTTSIYYNRFTENKIKNLINNTVKYILLNYNQLLKIKPDTKINNLMKMKYGDRIE
VELSDYDIIILFSRQPSLHKFNIAALCKIWNNTVGIPTPIANSMLDFDGDEVNEYKTQSPGN-
IEALFTMLSVNLVKNNYNSPIFGLIQDQIIGLHLLYKEEYDINEVIYILGEYSY-
FIRDNLKLYSGSELLSLIFPDNISYEGVFDNGELIINNISRFFVVSQSYLSNLMSHYKNNVFAVQIIDT
LLYIVRNFISLYGYSISLLDIPDIKFINYIYNYIDCCKVIQYVMGKYNSISNHDILLT----
YDELENIRINNCTNIINNVOQKIIELFKDNPLNAIVAANKSEYKITLDELVTVLGCTGQQGIDSNDIKPG
IMGRVFNLSILPSSLDIESLGFIKSSTLKLTFKELGFHTYNSIKKILRITCETSSAGSTGRKLVKFMEGV
KIDHYGRAVLHNTVVWQANANYLKMGLSDIVRVNILEPDDNMENYNIKKLYDDNKYLLSDNFTRINKEF
LFPINIKLEIQSKSKIDLAKDLNKNIEKFINYIHLNIYFYLDLTFWKYILYTYLDKFTIISYSAELIDY
ILDKIKLKLNSLSPGYTIGLEYAHNIQEKFTQQSLSSFHTTKKSGTAAQLGFNDFKDTVELSRNKPDI
TAYSTNKLEIINVEYLSIKFFNPDISIIEENSGLV-ISIINKFYVN-
KKLTLMQYYQMFLDFLNCIIINSY--
WSKMLYKDIIDIIITIVAPYNINKIYFMQGISSAVYKGMANTNIDINIKYDDNMVQVDYRLRFYIENV
YDLSNFDTRDVLGWPFAFYDAFGIQAFAEYSICNRLINSTKE--
KSMEICYKILSKLMCLSTDMYNIKRLRDGKNSILKNAIHGVSDSIQNSAFNNIIDTGTDIYSQIFENSLL
NIGHGYYESYLNLNKYDSISIKKEILEKNIESIENFMEEINVLIKEFIEFYNNVDDDKLHNEVEITYLFP
NLILLSNLYYDECKKTTYLEFSLDNKKRIKFRQIVPYTTQDKFEIKNSYLANKLNVNKLDIKSEISNKNI
LEIIFRHSTEDSDITLPSKQELNQVRLTFVNIRIMIDNLIIEFKYKANLGSASSNSSTYLNNDITARILT
TYYLEIEELLNTKIDNDILINVLNKSFGYIFSIRNLDNFSLSEYVPIKTFMITYDKLIIDKSAYVMTPKIN
GEVYVENG--
ICNITIYNFIYKINCINKNVIMGEGELIIDNKHIFPFYFNLIKDNSYTDYKQEFYNTSIINFSNMKIH
FNKNIFKFNNTVNEVLKFYRSILNDGVILLDISNNNVKDYKFKLDNTVDIIAKLTHK-GIFRTQKDG-
LYLTLSLYNDNKNFVKMLEINLNKNEISYDNVINMLLFKNVD--
FGPKILVSPICYIVEYSFSSTIIKLRIEKTNKFFRNNGNLLNVILSQFHEKDNKLDYMIELNKSNNLL
TETRSKILNKDVQYFLEQTRTSLNILTNYIKTEAISITVSKLCSIIPN-
RHVLSIDIGRGGDLRKYVYVGISMLGTEPDISALETARSRYKEFQISSRAKSYKFNSINISILDDNYINR
VKEIYLIPQFGVIEWQLAIHYSYNEDTKNNILYKLNLAGDGTKIIITCLNGDLLSEKLQNNPHLNYKI-
SDTIYYKISKIDDNRISVLYNATMSTWLEEFLLI-
KKTIIINDFKNYFVLDIDFTFDKIFNNDINKMRVLAVFNRKSTKDFYSNIINDKNYENKELQELLSFFIV
YIFRYSYKTDFTKEKIDAACKLIKNSDSNECISSEKFFYLITNIKLSCTSSSTCLYCTSDIINIILETKF
NNTG-
FCSMICSNSICKQIYTLPKYKNNYLIPYELIRNKNHINKIINLRYELNLYGGITHDKYNKIEFFITKQ
-

>Melsa

MNRSLI--

LYDNSNSSRLNIYTLCQNEGNYNIPQFTSSSSVYENLYIYKITDSKLEGCNNFGLIITLPEIKGIGSIRY
QSNFVYKLIIEFVIETIDNTIIKSGLELFEFNRSKYSKIIGNNIDLCFNTGYTADDIIFTSREIYFP
LITIFDNQNPHTCLRLPKTKLQIKLKLDFKNVMVYDKIYLKNSLITNIDLQPYISFTGYNTTGSEIKNR
FLEELVNCTTNCNKIYYTPDFSSITNVLWSIKVFNGKSFISYPNYPETEESFIKSYVDKILQDLLIVDF
NAKRKFNKKCKFVEIKPDVVKHDNNQCIINIKGIPEGMKLYYHKNILSFRRNKNDEYNISNKFILGEY
LEKEDRIYFIDVKHDISISDVSIPIEIWNAEENTSTGDLRSDKMKEMDVIVYDNFIFGMDFISKLGIFTS
TLKTNSETIYEFYLSNVCVYTPINDESYPISFIHRFNQHSLLSEPSRLIADNDKNFRRISICINWKHYP
DTDPRSFLKQYMIIGMTIVKKVTYDNNIINVHIVD-

MDKYIYLQKGLKVKLLKKKEYVNQIDKLTLEKINNAIENNDSIEEYHEIILNEHDRFKLFFDIELKKKYN
SDYFDSTFENFKDEISSFLASVFEFELNEDDLKNIFDGISATTSNDPNKISTHVFFTNILVSNVFTTLK
IHIHNYKKRTTNELILGIDEQVFNNTLLRCIYSKKS-

NSKYYHEYDDQNDLQKYLVTFVDDDEDNIDLIDTDTECLTDIFPHVFLEKRQTITIDSNTTLIKNLETIEN
QTLDIYLTQTH-A-C-

ICGKITHKNHHYLLFFNQNIQLIKYGNRHNCRIIKFYPKLDSTAITKFIKDLDIRKVNKDLKLYWDGMKW
MPIIDDMIYKIALKLLDEYKNTHDKYVSTKYFKEAKVRILTDLDDTDYNTNPLYIQMCGIFDLNINIF
IYGIEAKKYIKPNYIPLSYKNIEMEEENNYMENYNLVTVINNIPENHKDRKIFECNISSLLQISKETIT
FLVGPTKSGKTTIKLLAALFGNLFITPIIDYVYKQHNHSPNAWLKGLNGKLVCFASE--

SNACDKFDSQTIKHMTERIISRVLNSNEGDQHNATQIIDTNIFFSIDITDMAILERLAVINIDHSYFN
STKNILNILDITRPRNPNFSNKIENGDFSLALFNILKEWVRKYHLDLKIHTPEFKTTNTNKKMD--

TPNEDNQNKLTLVSSINFNNKNIMNIKCYNRYYSTIKKLRSRKAIEIIVNEKFIEFPNEYKKYVALEH
LIEPMNKILEDLKEVPLYIPQILPHQLATLDFLNERSLKEKKSULLFHKMGSGKTIISLLFSIIASIEK
ILIILPNTSIMDIWISKLYDSLNDKYNLNNIEFTTRSELLGTNKNINDIITENIKKYDNYIIIIIDEA
HNFFGNASGELLIHIKQNSTARYVLLTGSPISNTIESLKDIVELLTNETFEYNKYISAGNKVFQQRINKQ
GIELLKNKLTGLISYDDEDRKDIPSPIFQGNKLLNYPVVLCPMSKLQEDNYNMISNQTEMDFIKLMNV
SLVALGDKENYTNFDLLMASNKQIFPNFYVSNKGFQELIDLNISSKLYFMNSITSPGKRFIYFANST
IGSTIIRSVMIANGISEYDKEIVNMFVCLKERKFVIITSKNNSYINKILSVFNEDNENGSVIMFLFGS
RIIAEAYTLKDIKEIWFLVTPETKSELEQCIARAIRSFAYKDNTRVVVRIATTPNALSNEISQIIIEKY
KDELSLDPYDLRQLYSEFKSEKAKVAYNIFINLSITNNILNDNILKCFIIEKIRRYSYENSRYKLKDSY
IKKNLKF-DYNKIEDYVNEFVNDGVVYVYKSGFTCYIDWFKDDIVVKQIILEFNYYLLSYNY-----

IRIHIINWYQYNYSKLERIVCKCKNDELIFFIIDFYHYFLCSKELVNNNDLKNIDNLKILDVDLPKY
NFEEINIKRNLYLFTIFKIQLESFNHSFLDYRWYVYVNNIDPSACYNIDDCKIFVTKTYVSNPKLFMNK
IPLPK-ISRSLFDIECKQTGSFPDPKYPISHI-

CCFYDDKKNILILTNCNLYEKAKNKVYDMECEKINMNSSVIKIYTSEKNILIIIFQCLLFHEFDYILSFNG
HEFDIPYINTRMDIYNLKLMLNPFPGFNLNVI-----KGDASSRY-

THIEYSSILFDLYVYTKKTYVLPYKLETVCKTKFNINAIALIENTNVKIPDTKNKLKIFYSVIRTANYC
FINDIAYQINKNDIIDNMQAINQSIGVPFIVTGNIVVALSKDDIDIGDITYENYTIKANEIGNYCIHDTV
LCNKL FETDLIHEVITGYSSQYLLPQNQVFNFTSSNTATGQLLYTLLQEKQMFKKYITEDEYEGAYVFD
KKYITEPIILEDYTSLYPTIMRQINASPEKIKVITSNDNIMNAKIDNYIFNTYNYPEYMYIDITN--
SNLTTFIITDCRKGDIPLMLKQGMKRSFYKKKMNDANDILYNVYNSMQYTTKIFINSIYGLMASETFM
FNSKYCAQFCTALGRKCIKYTADILNNSYNINGIFVNNVNIFTKTHIQTKYNSNIQECFLEIVYGDTSV
FIIVHFKNLRCKDIGIFISNTISTGIFPKLFNLEFGGVKKWMLFIEKKKY--

ISYDIINDTLAKIESKGTSLIKRDYSNFHKHHYKTIIEI IQS IENKNNSKNVVIKYIDELIKNLVNLDK
NYM---

FAVTKRYSGKYVSIDNIIETVNKFNKYPDKIRKGRFLYIYGIYMKSWNISIKDISKMMIIPSNLNMF
NERICIESYVIKLITDVSQLLDDKEIT---EKLSKYKKK----

MYSKLSPALHAALRSRINNSVLCYDIMNPIIYNDPNTVNLIRIPPR-----

MLKNISFNLKISNLSNLELRHQKHIFNKIEIYNIENSKPLYISLVCPGFGKTIISIAIINKLKFKCVI
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IHKYNLNNNDILMTKFLYKKNYFKMCLLLTATPANMNLVTHMIKANGEQNQTKNILVSDINNSFSNNSIN
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NDSVYLYDVKQKNSVSSLNEARNKNNFIIIVSTIACSESLDLQSLNTHITLPTITNKTIIQAIGRIFRTN
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KKFTNTLNDKSTLIIIFDDVGN--FRNKLKNFTNECRHAFISTIFLVHKEIHLDPDTRDSMKFFV-
INKKTIDLKYIIPNTSIR--KEISKDIVPLLYKKFGLYIVIDNHAELFYIYISEDEM-
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PQFINDHVILTFTLEQARGYIKNILGLSDDIILFSIWNDFDYLLK-
NGIFDPYNIQNMMLLVEPNDSILYNIYQNIVEVFCVTTNKNIGSQLARSNVYSEIINNIYKNRYAMKSSII
D-AMEYSINIDFQDLLR-----ISNIPDYNKTLCSYNYFYIKGNKITI---
DNFDSMYEKYLKIYDKN--
ININIYDDVLYVKKLSDFTDILNKNINIKSLKPKTTIYVYFNTFLNPNLTIEFDFDFINDTKTKNIFID
LTGKINIMTSQSHISYRSYNISTDLAKYFTLFLILGYSHIFNKVQSKAKIKKIDELYPSCYQNYKDIKRO
PILIDHIDESLIKISDNFYTGKEDDVYIDSNGLYQCSIY--
YSNMGFLGNIYSATGICYCCYSKPKIRDITFNCTVHGTKIHEEINPIIVNYGRILNPSNLSNLPYKLN
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PSTIIKDFNEMYNFIIENNAIFNDNMMYTHKDIENNSIFILIQNRIHQFKINKEQDNDITVIVKINLI
KNKFSVNNTKEISENGITVKNKCYIDGELVKNKNITYFTKFSNITIRPKSISEYFKKYIDDIYTDNLF
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SVIIDEIHEHDKFGDIAIAIARTKKKIRNIVLISATIESDIDNIRIYFKNIVEIYIPGVSLFPVKEI---

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KEFDITFHKPIPIEK-DIVNEAIAYYKSLD TDGVI LLD---KESNDYKLIKIDNTVDVIASLTHK-
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>Mytse
MKRSCI--
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-
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original alignments for 13 conserved proteins used for Figure
3 tree #####

#####

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YMP--QYISVNG--YYDRKDQNDTSHHHTISFDIRDQHISAVNYFVL-----
SIELPEVSGEGEFA-----YVPYVGYKCIQRVIITCGD-----ITIWETDGEELFDKCVDDDIAI-
MSGYSSE--LNDVSIQYTPN-----DTIKEHTTVVYVIKSPFDID--KTISSLKL-VNSKITVTVT-
FRSI-----NDVIVYDS-----KFQAEKF--IQEFVYSPELHLIAYAVNDIKPKS--
AYIEMDR----RLVSCSSTPAPIPVISDVYACSEVSIVYVKP--

YYGMENKFISYPGFKQNESDYIQSLVNRLDD-LVVVTD-----VPKDF-P--
DSAMFLKVPVS-----GKITLQ-DVDIVVKIDNVPEDKDVYY-----
HSNLLVFSTRKNSFV-----YNISKKFSTIIGTYSLITDSIN-----FSNVVHSIS-
ITDASIPVSWSSQKNVYPGDNRSSHSHSKDLV--VNDPFRKGDIMVNK-
TEVISRLELKFNDPI-----YTETLPITKIY--N-----
KLLTGTRVNMRLKLI FNM PANIFRPTTLNANTKRGKDKLTVRVSVDIDPNNPIHYVAKQLVVICTDLR
IDYDGK-INVTKITE-----

>u1_Orfvi41057138

-----MNNSVV-SLVGGD--DAVRRAS-VFATDHRAPT-----
YMP--QYITTQGVVDT-----TSDAVTTFEIRDKYISAMNNFVL-----
SVDLPEIKGVGKMC-----YVPYIAYKLIRHAVNSAA-----DTIWETSGEE-
LFDSCLDNERMELSGFSRE--LNDLSTGSSPN-----DVIKEAACVHAYIKTPFDAD--KTFSTLKL-
SDSKITVTIT-LNPI-----ACVMVYDE-----TFDAAKL--
AKEFPYSMELSFYGMVKNLCPRP--AFIEMPR----RRV--EQINHTTAVITDVHACTSLSVYMKP--
VLSDANNRFISYPGFQQSEGDFVMAFVERLLED-MVIVSNC-----YPEGF-P--
DTAEIVEVPPS-----GVVSIQ-DTDVFRIDDPVGMVFL-----
HTNILVFATRKNSSV-----YNMSKKFSAITGAYSRATSRIR----FTTAIHSV-
IGDASVPVGVWTCQRNVYNGDNRSPEARAKDLF--VADPFLKGVDFKNK-
IDVIARMDVRFVNEVL-----YSENSAVSRV--G-----EIL-
GKTPGVRTLQFNFTPSTFFSPTALNSNVSRGKDKLAVRVTTAHEAHNPLMYVPRQMVVVCNEVYRLSYD
AG-IVA EKVTAQ-----

>u1_Mo1co9629034

-----MNASIINSLIHAE--DGVRASN-VFGFDMHQPTL-----
YMP--QYVTVSGVLQP-----DAGHPVVAYEVRDQYITAMNNMVL-----
AIELPEVKGVRFA-----YIPHVGYKIRNVALTSVN-----GTWVEVSGEE-
LFDSVRGHAAALELAGHSRE--LNDITRGDSPN-----DTIKDASTVYVYLRSPFDCD--HTFSSLKL-
SDAKVTLAVT-FNPI-----SDVLVYDA-----AFDLDAF--
LRSFVYATELSFVGYMVRNIHAKP--SFLEITR----RQV--GQMNLP TAVVTDVHAATALAVYVKP--
YYGPVENKFIAYPGFSQSEQSYVCAFVERLLED-LIRISDA-----EPSGF-P--
EAAELVEVPPG-----GLVSIQ-DVDVLVRIDGVPAGKTVFF-----
HTNLLVFGTRRNSFM-----YNLSKKFSVIAGCFSPATGKII----FTSVQHTVS-
VTDASIPVGFVSSPKNVYHGDNRSCSSRAKDIF--VNDPFLKGVDFLNK-
AEVISRMEVRFVNDVM-----YSEIAPISRVY--N-----
QVLHGACGTRKLLFNFNPGAFFRPTTLTANPSRGKDKLAVRVVYSSMDPNNPISYVVKQLVVVCTDLHR
VTYDPY-IRVSKVSE-----

>u1_Squvi549059696

-----MNNTVISSLMHTD--DAAHRAN-IFSVDCKRPTL-----
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LFESVRS DPVALELSGYSRE--LNDINI GLTAN-----DTIKEAASIYVHIKTPFDVE--KTFSSLKL-
ADAKVTVTVT-FNPI-----VDVIVYDG-----TFDIDAF--
VRDFSVAEMS FVGYMVRTINNKP--SFIEIAR----KTV--SQINQSTAVVTDVHAATSLSVYVKP--
YYGNTDNRFIAYPGYAQSESDYVSAFVERLVED-LVIVSAD-----YPTGF-P--
DTAQIVEVPAS-----GVVQVQ-DAEVFVKIDNVPCGMQVYL-----
HTNILVFGTRKNSFV-----YNLSKKFSVITGVYSSSTNRVI----VMNVSHTVN-
ITDASIPVSWTCQKNVYHGDNRSDASRERDMF--VNDPFLKGDIFKNK-
TDVIARLEVRFGNDVL-----YSESSPVSRY--N-----
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LYNNCINNTIALKHSGYSSE--LNDISIGLTPN-----DTIKEPSTVYVYIKTPFDVE--DTFSSLKL-
SDSKITVTVT-FNPV-----SDIVIRDS-----SDFETF--
NKEFVYVPELSFIGYMKVKNVQIKP--SFIEKPR----RVI--GQINQPTATVTEVHAATSLSVYTKP--
YYGNTDNKFISYPGYSQDEKDYIDAYVSRLLDD-LVIVSDG-----PPTGY-P--
ESAEIVEVPED-----GIVSIQ-DADVYVKIDNVPDNMSVYL-----
HTNLLMFGTRKNSFI-----YNISKKFSAITGTYSDATKRTI----FAHISHSIN-
IIDTSIPVSLWTSQRNVYNGDNRSAESKAKDLF--INDPFIKIDFKNK-
TDIISRLEVRFGNDVL-----YSENGPISRIY--N-----
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VSYDQG-VSITKIMGDNN-----

>u1_Yabdi12085073

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LFISCRDNDTALKHSGFSHE--LNDVSTGLSPN-----DTIKESTTVYIYIKTPFDEE--KTFSSLKL-
SDSKIVVSVT-FNSV-----SDIIRDS-----TFNYETF--
VKEFVYVSELSFIGYMKVKNIQTKQ--SYIEKPR----RIL--GQLNQSTAVISEVYAVTSLSVYVVKP--
FYGNTDNKFISYPGYLQSERDYICAFVERLLED-MVIVSHS-----LPKFF-P--
DSAEIIEVPPC-----GIVTIQ-DAEVFVKIDNVPKDMKVYF-----
HTNILVFGTRKNSFV-----YNISKKFSTITGSYSDSTKRIM----FSHISHSIN-
ITDVSIPVSLWTCQRNVYNGDNRSECSKSKDLF--INDPFIKIDFKNK-
TDIISRMEVRFGNDVL-----YSETGPISNIY--N-----
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>u1_Myxvi9633724

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IYNSCVNNETAMANSYSHE--LNDVSVGLTPN-----DTIKDAATVYVYIKTPFDVE--KTFSSLKL-
SDSKVTVTVT-FNPV-----SDVIVRDT-----TFNYEAF--
VKDFVYVSELSFVGYMKVKNIQPKQ--TYIERPR----RVL--SQINQATAVISEVHVSVTSLGLYIKP--
YYGNTDNRFISYPGYNQTERDYICAFVERLLED-LVIVSDT-----VPSTF-P--
DSAEIVEVPPD-----GIVNIQ-DVDVFKIDNVPKDMAVFY-----
HTNVLVFGTRKNSVV-----YNMSKKFSTITGTYSVTKRIM----FSHISHSVN-
ITDVSIPVSIWTCQRNIYNGDNRSEYSKSKDLF--INDPFVKIDFKNK-
MDLISRLEVRFGNDVL-----YSETAPISKIY--N-----
DLLSGCDSGIRMLRFNFTPHTFFKPTTIVSNPSRGKDKLSVRVVFASIDPNNPISYVSKHLVLI CHDLYG
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NCV0G0023, D5-like helicase-primase

>ASFV_9628179

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DLKLNTNAVPPLEPPALSRLCHRI-----FVHIKNSSVLP-----
EGSHKIHFFFTLKPEVVQGYGFHVLIPGLKLAASKKSIIGSLQHDATVQKILHEQGVANPESCLDPHS
ASVPSLLYGSSKLNHPYQLKTGFELVFDSSDPDYIPIHQI-----
KNIESYNLSELSLTNEQGSVLRPVYCAADIAAEKEEEIP-----
TDDHLSILMLHDPEARYLHKIL-----
NLLPPEYYVEYPLWSNVVVALANTSANYRPLAEWFSQKCEKWNTGGKEKLEKLWNDASRHTEKKITKRS
IMYWAHKHAPQQYKEIVEQGYFSILAEVVSNGMLEHYMIAKVIYAMMGNKFVVDVDSNGKYVWFVFL
PGQPMNQGEIWKWRKEVNPDELHIYISENFSRVMRITEHIKYHLSQP---
HETNILNYYKLLKAFERSKSKI FNDSFKKGVIRQAEFLFRQRSFIQTLDTNPHLLGVGNGVLSIETIPA
KLINHFHEHP-IHQYTHICYVPFNPENPWT-----
LLLNALQDIPELDARLWIMFYLSTAIRGLKEALMLLWLGCGNGKTFMRLVAMVLGDHYASKLNISL
LTSCRETAE-----KPNSAFMRLKGRGYGYFEE-----
TNKSEVLNTRSRLKEMVNPGDVTARELNQKQESFQMTATMVAASNYNFIIDTTDHGTWRRLRHYSKVKFC
HNPD-----GNPYEK---KEDPRFIHEYIMDPDCQNAFFSILVYFWEKLQKEYNGQ--
IKKVFCPTIESETEAYRKSQDTLHRFITERVVESPAETVYNLSEVVTAYA EWYNANINVKRHIALELSQ
ELENSVLEKYLQWSPNKTRILKGCRI LHKFETLQPGESYIGVSTAGTLLNTPICEPKNKWE-----
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-----MDKYI-----YLQGLKVKLLDKKCCILEE--EYVNQIDKLT--
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KKKYNSDYFDSTFENFKDEISSFLA-----
SVFIEFYNINSTLELNEDDLKNHIFDGISATTSNDPNKISTHVFFTNILVSNVFTTLKIHI-----
-----HNYKKRTTN-----ELILG---IDEQVFNNTLLRCIYSKKS-
NSKYYHTEYDDQIESVNDLQKY-LVTFVDDDEDN-----ILIDTIDTDECELTVE---DGI-
FPHLKVFNGHVFLFKFRQTLFKAS---ITIDSNTKTLIKNLETIEL---NQLDIYLQTOH--A-C-
I-----CGK-ITHKNHHYLFFNQNNIQLIKYGNRHNCR--II-----KFEYPK-
LDSTAITKFIKDL-----IVRKVNKDLKLYWD-----GMKWMPID-----
DMIYGKIALKLLDEYKNTMLLHDKKYVST-----KYFKEAKVRILTDL-SDSTDT-----
YNTNPYLIQMCNGIFDLKN-----
NIFIYGIEAKKYIKPNYIPLSYKNIEEMSEEEYNNYMNENMLVTVINNIIPENHKDRKIFECNISSLL
QISKETITFLVGPTKSGKTTIKLLLAALFGNLFL-TIPIIDYVKQHNPH-----
SPNAWLKGLNGKLVCFASE-----SNACDKFDSQTIKHMTERI-
IISRVLNSNEGQDQNYATQIIDTNI FPSIDITDNAILERLAVINIDHSYFINSTKIDSVNENILKDRNNI
LDTRVIRPRPNPFSNKIENGDFSLALFNILKEWVRKYHLDE-----
LKIIHTPEKFIKTTNTNKMD-----TPNEDNQNNKMLTLVSSINFNNTNKNI---
KMH-----NIKCYNRYYS-----
TIKKLTRSRKAIEIIVINEKFIKEFEHLIPNEYKKVILNQPYVALEHLIEPKEI-----
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-----MLKNSI-----YLQSGLCVSKEDKYNLWV-----
NNIETSNVFSIGLDELLNKIKDVIDNEDNPLPEYHEFILEDINDYFKLFID-----IDI---
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SCFLQYNIQYIDIDETKFELHNYIHDNIYFTISNPNKISIHVFFDNIYVNENSFSLKNNI-----
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DSIYYHKIYENDINTIDDLKHY-LFTYVDESPLH-----IKLLANSITN-KYDNHNNLDKI-
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Y-----CLKKDKHKHNYLLFNAEYILLKRGKINSCL--PK-----IFTYPR-
LTSYEISKFIVSLD----IIKKINNDIYVFD-----NKKWSKLD-----
ENIYAGLALILCEHFDVLLNDRDYIAN-----RYFKEAKNTIKSHL-SLGYND-----
LCNNPYIIQFRNGVYDIIN-----
SKFYKGNDAKKYIKLSYINIDYKDENDMSESELQSFTKNYNDLKNINLIIPVDHKL RHVFEANLSSILL

AYYKQVITIFYGDTNSGKSTIKELIRSLLSTMFI-EIPIDNYTYEVH-
KDSKKKIGPDWLGKVDDKLVSFASE-----ADYNETFKLSLIKRMTEPY-
ILARDLRNNKCDQLNTLTQFIDMNHKPKFDGIDTAIFKRIAIININTTYFVDENL-----DEFII---
ERASNNRKIIKRDNMLWNRIINKDFTLPLFYLLRCWVLKYHMAN-----INLLSTPELI-
YNNDEKDNTTSNDDTITLTKFCSGWGLKKQDIRANARDYYDEEIIDISTGTYK-----
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YKYSEIWDRLSEVI-----

>u2_Mytse506497828

-----MNDIV-----YLQKSLAVGKSEKYDFVNNNIRDKNKKLCKKTI--
SKFVNKI IDC-KNSGNSLDEYHEFILD SNNTYFKLFFD-----IDY-----
KTSNDHQNIDTYISEFKEFISIEL-----
YNIINKNYDYTTTRDVDN KDIVDFIKDNIYITLSNNPEKLSLHVFFNQLLVTPKSFVTLKKYI-----
----NNLKSKTNN-----LLIHN---IDLAPFRKYTQLRFIYSKKN-
DSIYYHSEYNYNIENVDDL RKY-ILTSIDINNKH-----IIIESKKINEYVDN-----
IGIIYPHIKYFRGESFIHNL YIDLKNEYCVKISTESFQLFKQKHTATF---NETIDIDL VFEG--
RTCSF-----CGK-TLHKNGRFVKFVENNIQIIKRGNSSNCR--IL-----SYAYPR-
LGGFELADFIKDL D----IIKKIDAELYVFWK-----NGKWVKIDS-----
PSLFQGITKSVDLNNKNMILHDIEYMSN-----RFFNECKNRIMATL-SLNTSE-----
LCKNPYIIQFNNGVYDIQS-----
SKFYEGDDAKPYIRLHNIRINYKNIDNMSVDERQIFDKNYNILLDTFN YIIPENNPCRSVF EANLSSVLH
YCHKPIITIFHG PASSGKSTIKALIRQLL FDMFI-DIPIEFYQTNNSKN-----
GPNAWL GKVEGKCVSFASEG---EMGGDDKFLAKNIKQLTEPY-
INGRDLNCSKCVQKNTLTQFIDLNPNI FSSVDAPVSKRIAIVELNH THFVNEKL-----SRETI---
NITSGNRNI VTI DEKFDSKI INNEFTLPLFYILKKWSNKH HKNT-----
IKLLNTPDIF-----

FNN-----

>u2_Amsmo9964401

-----MSDEYI-----YLQKSLNVTKESKIDLIL-----
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KTEYEIDDVKKYIKEFKK FISY-----
ELYNIFSNNFDIENHNIDNIKKFIFNNIYYT LSDNPHKLSLHIFFNQILVSPTSFIQLKKYI-----
----INLRSKINN-----ILINN---IDLAPFRRNTQLRFIYSKKN-
DSEYFHSEHDYNIENIEDLKKY-IITYKNFNEPH-----IIKAKDNNLTNLD-----
VIYPHIKYFRGPHFIRNISKELYN NYK-ITISDDSIQLFKKKHSAEL---DEIIDINLIFNT--
PDCKI-----CGKNSLHKNNRIIKFTEQKIILFKSGNPRNCN--TL-----KYDYPT-
LSGYELANFIRDLN----IIKKIDSDAYVYWK-----NGKWAIVDN-----
PYIFQGISNMILEKYRNNMLIQDIDYIIK-----KFFGEAKNRISANL-SMNTDI-----
ICFNPIIIFNNGVYDLKE-----
SKFYTGENAKKYIRLNYIKIDYKDIEDMSDEEKIKFENNYNILLKLFNLVIPKSNPKRIVFETNLSSVLH
YCHKSVITILYGP TSGGKSTIKYLLRQLL FDMFL-EPPIEFYQNYIPKN-----
SPNSWL GKVEDKLVSFASEG---DVNRNEVFLNKNIKQYTEQY-
ILGRDLNKS KCVHKNTLTQFIDLNP KPMFSSVDPALVKRIAIVIEINETQFVNEKL-----SRDTV---
NITSDNRN IVIADSTFDDKILNNEFTLPLFYILKKWSK KYHKDT-----VKLLYTPDFF-
DKQN-----

>SGPV091

-----MFNYQNE-----IYIKPLKTSKIDPLD-----NKFEHTKIFS-----

SPD-EVY-KWANGSNETYEHIVSDTF--AVKLFWD-----
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VTKSNNDKISYHVIYPNFLVAPNDWCMLTKSL-----
EGLVNSQINNKHSTSLKKNLLKA---IDFVWKEFPTLRCAYSIKSCEDTSVHTVII-----GTFEDS-
LISWIPETTKA-----QYWLIPTHSEEAAD-----SVLDDPEITLLEKSNLYNQEVN-----
RILTEVFGTQLEHYDIYM---EG-QTYQLDQVDYSCNPCPI-----CFV-
SLHKNNHFCKRQGKLIISKHGNPKKCKRQVH-----TLNLKE-DLYLTIAVDIYSRN----
DIKKYQEDHFIIWN-----GVNWSFDKA-----TYSITSYILRISSSIEDS--
AIKKELQDY-----RKRKMVENNLIDLIGAENPIR-----
VDSIPYVLYFQNGCYNILK-----DEFYEGPSAKEYIGSVNTGYMYKSAWDI-
DEDIQNAMKDIDLIIQIQQPTEENKEERELEYEILGSCLYGSHKEYMTFFHGD TMSGKSTSKKIVNAAI
GNFML-ETNSNLLTEVIDAK-----RPNPFLAQINHKRALFASELPN-TADSKFKIKGVNVKLTCHK-
IISRLCYSNAIEQQNFATFIVDTNHEPFFDIVDGAIVRRCLMINFKSAFIDEKSR-----IL---
VGVRKN--IFPIRMEISSRLETQAYRQACFLILKRFFRKHFLTPENTIFLPFKTTPEKF-
KDFTLIRKIP-----TLIVQSSTETIEDILPKYSAKYDTF-GDT-----VY-----
MEESDFKSYIY-----KHFSIKLFGNEIQNMINTHSHTDTS----GHIWVK-----
YIVKKHLITYSEE-----

>u1_Nilcr115531777

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VPELEEY-IRARPECTLFECLKNEEENSRRVRFVD-----VDL----
REPLVAEQFAESFKTFLLLLTKFLAD-----FVFKHC--
AASVSGSSKRAFLVAARSRYSLSLSDDPEKVSFHLIFDTMYTSVRTLVAMRRFL-----
SREVRSSVN-----PLMRA---VDVAVYRRNPSLRVVGTRKTPECRYVHRMTAS-----TDLADY-
LYTYVDVTPSS-----YVFEYAEAP---AP-----DRAAAP-----GAVSMSFDKIL-----
VRLQTIQVNEITNLDRLNA---NTPGTPLIIDY-RFPICRL-----CGK-
ASHKHPHHVAVQEDTLRIFKAGNPNSCR--VK-----TVPLAQ-NKLFAISERIMEAG----
VVHKNKYGEYIAWI-----AGRWETED-----NNHLTRLVLSMKDAVDDD-----
EGLVLP-----SNRRIENNLKDMI--TSCVA-----
TDLFPEKLQFDNGILDVAT-----REFHRGEEGKDFVCTVSTGYEYAP-----
TPAGDPAVTELRAVLDDIQPPTGGNAGNREVERVLSSCLCGVNKPYIFFFYGDTSSGKSTVKKLLRSVF
DGLFT-ETSQCILVEPFD-K-----GPNPYVSSIHLKRVTFCELPDFSCNNVKKIRSDNVKLTENC-
IVGRACFSNKISNCNVSTIIIDSNYKPVFDKVDNAIMRRIGLIHFKTHFSPNLNR-----PCL---
GNSYDV--VKLNAALESKIRTNYFRGAFLTLLEWYAKHHLHG-----LSLEPTPELI-
PDFRFRRLTD-----TIIAPSDSTHAKHMPSLVRRGYHVSEAGL----PA-----
LSADGFRTRLV-----SHFNVKIYGSDIDGFIKKNKYTNF----CDEYME-----
YVFIEDLGSK-----

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MAPHVIRNNHIV-----FVLKKIGVSTKHRNN-----NDIRYVESFT-----
CEELERY-IAKNPGCTLFEALKNEELYSNIRVFFD-----VDM---EGTLDDNS--
SAINDFMRVITKFIAD-----YAFDSC----
KMNTEKDKQQMINDMKENFSITESTNTEKTSFHLIFFNCYTTVDTLINMGKKL-----
LPLIKQSN-----RLIKA---IDTAVYRHNP SLRVVGTRKTPDNVYVHSKTDNR----VPFKNY-
LFTYVDFKDD-----CYYFVDESNNQSP-----DLLNWR-----DEYIPFHDAM-----
KKVCKVIGNNINLKEITP---ENL TEIPLNINY-ATPCNL-----CKK-
VSHKHPHLLIDNDCIRIICKGNPNCK--IK-----VIQLEG-NKLFSISQQIIDLN----
VINISDRGEYLIWL-----KDVWRMCD-----ESNITKLILYMKDYISSD---
CTGLLLCP-----RNRKVIENHLKDML--IDPIE-----
TDIYPEKLQFTNGVYDIKD-----SVFYQGNDAKNFVCTVSTGYKYED-----
KEDINGVIEELSKILDDIQPKTKENSENRELYEQILSSCLMGTTKQCIFFFYGETATGKSTTKKLLKSVM
HNMFL-ETGQVILTEQMD-K-----GPNPFIANMHLKRAVFCSELPDFSCNTSKKIRSDNIKLTTEPC-

IVGRPCYSNKINNRNHATIIIDTNYKPVFDKVDNAIMRRIALVNFKTHFTNSRKK-----VY---
NTKYDF--IKPLNEGLDSKIQSNYFRYAFLKILLGWYQKYHVPN-----LTILPTPKI-
PDFKFRLKID-----ALIIPSSTTHIKYIKELSKLGYIIDEDGL-----PV-----
LYVSTFQOKLQ-----VYFNVKLYGHDIESFILKNKKYINF----TDEYMS-----
FIFIEDLNNINVSTDISNTE

>u1_Orfvi41057131

-MAAPICDNSHV-----FLLKRLGVPSSCRRS-----EDPRFVEILT-----
PFELSNY-IERHPGCCLFETLRDEEDCSVVRVFAD-----VDM---
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GTVPGEVKRAMLANFSVTRSTAETHKTSFHLI FTETYTTLDTLVAAKRPL-----
LDLCRRSDN-----VLLRA---LDTAVYRHGATLRVVGTRKTPESSAVHRMQSPD----DDIKDY-
LFTFVELSDAS-----VYFELAEREQHTLS-----TVC-WE-----TSYIPFGDAM-----
RRVCQAVVNDIVNLRDITE---DNFLDTPLVIDY-ATRCAL-----CKK-
PKHKHAHHITMGNGCLRLVKGGNAHSCK--VK-----IIQLEG-NRLFTAAQIIIASE----
VVKLTERNDYIVWL-----NNSWRFSAE-----ESLITKLILDVRHSLPAD---
YANDMLCP-----RKRKVVETNIRDML--VDISE-----
TDTQYDKLPFTNGVLDLAT-----GEFLTGDRAKACVCTVSTGYAFSREEFA-
AAADSEAMRRLVGVINDIQPDTPENAEENRALYERAMSSALCGATKTVIVFFYGD TMTGKSTSKRLLMSAL
GGLFI-ETGQTVLTDVLD-K-----GNPFIANMHLRRAVFCSELPDFACNNARKLRSDNFKKLETPC-
IVGRPCFSNKIHNRNHATFIIDTNYRPVFD RVDNALMRRVALVRFRTHFSSAATR----AAAAH---
NVEYSA--VKEMDES LDTKIQRNYFRYAFLRLLVQWFGKYHVPQ-----VSLAPTPDAV-
PDFAFHCRVA-----ELVVASNDTHRRAMESLSKLG YVLV-GGN----VA-----
MPADAFRQLA-----AHFNVRVHGGDIDAFMFKHKKVVNV----TEEYVE-----
YVFIEDVENK-----

>u1_Vacvi66275907

-MDAAIRGNDVI-----FVLKTIGVPSACRQN-----EDPRFVEAFK-----
CDELERY-IENNPECTLFESLRDEEAYSIVRIFMD-----VDL---
DACLDEIDYLTAIQDFIIEVSNCVAR-----FAFTEC-----
GAIHENVIKSMRSNFS LTKSTNRDKTSFHIIFLDTYTTMDTLIAMKRTL-----
LELSRSEN-----PLTRS---IDTAVYRRKTTLRVVGTRKPNPCDTIHVMQPPH----DNIEDY-
LFTYVDMNNS-----YYFSLQQRLEDLVP-----DKL-WE-----PGFISFEDAI-----
KRVSKIFINSIINFNDLDE---NNFTTVPLVIDY-VTPCAL-----CKK-
RSHKHPHQLSLENGAIRIYKTGNPHSCK--VK-----IVPLDG-NKLFNIAQRILD TN----
SVLLTERGDHIVWI-----NNSWKFNSE-----EPLITKLILSIRHQLPKE---
YSSELLCP-----RKRKTVEANIRDML--VDSVE-----
TDTYDPDKLPFKNGVLDLVD-----GMFYSGDDAKKYTCTVSTGFKFDDTKFV---
EDSPEMEELMNIINDIQPLTDENKKNRELYEKTLS SCLCGATKGCLTFFFGETATGKSTTKRLLKSAIGD
LFV-ETGQITLTDVLD-K-----GNPFIANMHLKRSVFCSELPDFACSGSKKIRSDNIKLETPC-
VIGRPCFSNKINNRNHATIIIDTNYKPVFD RVDNALMRRIAVVRFRTHFSQPSGR----EAAEN---
NDAYDK--VKLLDEGLDGKIQNNRYRFAFLYLLVKWYRKYHVPI-----MKLYPTPEEI-
PDFAFYLKIG-----TLLVSSSVKHIPLMTDLSKKG YILY-DNV----VT-----
LPLTTFFQOKIS-----KYFNSR LFGHDIESFINRHKKFANV----SDEYLQ-----
YIFIEDISSP-----

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-MAGSISNNEHV-----FVLK SIGVPSSHRQS-----EDPRFVDIFT-----
CEELESY-IEKNPTCTLFETLRDEEAYSVVRVFFD-----VDL---
DAVLDEIDYIAALEDFILEITNFVSK-----FSVMEC-----
GANQNTVLKCMRSNFS LTKSSNKNKTSFHMI FPDYTTINTLIAMKKPL-----
LEFLRSEN-----PLIRS---IDPAVYRRKATLRIVGTRKISNND SIHLKQPPH----DNISDY-
LFTYVKFHNS-----CYFSLSKRLEDVLP-----SSL-WE-----PNYIPFNEAI-----

KKVSKIIMNDIINLKDLDI---NNFTTIPLVIDY-VMPCAL-----CKK-
KSHKHHHQLSLGNGMIKIYKAGNPHSCK--VK-----AIMLEG-NKLFTISQLIMDAN----
VIRLTERGDHIVWI-----KNSWKFNNE-----EPVITKLVLMKMDQLPSE---
YTPDILCP-----RKRKVIENNLKDML--VDTVE-----
TDTYPHILPFGKNGVLDITS-----GKFYHGEESKKFICTASTDFNFEMDKFL--
NDTSIEMKELECIIDDIQPKTCENLKNRELYERTLSSCLCGSTKQCITFFFGETATGKSTTKRLLQSAIG
DLFI-ETGQTILTDLMD-K-----GPNPFISNMHLKRSVFCSELPDFACSGSKKIRADNVKLLTEPC-
IVGRSCFSNKINNRNHASIIIDTNYKPIFDRVDCALMRRVSLVKFRTHFSQPSSA----EAAKS---
NSAYDD--VKPLDENLDMKIQQKYYRFAFLNMLVKWYQKYHVPT-----MRLFPTPAV-
PDFAFQLKVS-----SIIIVASSSTHLSLISKLSKIGYVIE-NDL----IV-----
LPSNIFQQKLA-----GHFNIKIHGHDIESFINRHKKFANV----SEEYLE-----
YIFIEDITSK-----

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CDELENY-ICNNPTCTLFETLRNEEDYSVVRVFFD-----VDL----
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DAPQNKVLKCMRSNFSITRTTDPDKTSFHMIFFPDVYTTMHTLIAMKKPL-----
LEFLRSSEN-----PLIRS---IDPAVYRRKTTLRVVGTRKAANNDKIHKOPPH----TNISDY-
LFTYVRMHRDS-----CYFSLTKRLDDTMS-----EAL-WE-----PNYIHFGDAM-----
KKIAKAVVNEIINFKDLDV---TNFTTVPLVIDY-VMPCAL-----CKK-
KTHKHHHMISIGNMLKLYKAGNPHSCK--VK-----TILLEG-NKLFTISQIIMDSN----
VIHLTDRGEYIVWL-----KNAWKFNTD-----DPIITKLVLMKMDQLPTE---
YVPDILCP-----RKRKVIENNLKDML--VDVTE-----
TDVHPCILPFRNGVLDISN-----GTFYTGHDSKDFICTVSTGFNLNMEKFL--
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SLFI-ETGQTILTEVMD-K-----GPNPFIANMHLKRSVFCSELPDFACSTSKRIRADNIKKLTEPC-
IVGRQCFSNRINNKNHASIIIDTNYKPVFDRVDNALMRRISLVRFRTHFAQTATN----KEMLN---
KAAYDD--VKPLDETLDMKIQKNYYRYAFLNLLVQWYQKYHVPH-----LKLFPSTPENV-
PDFAFQLKVE-----SLIVSSSSTHTHLISSLSKIGYVME-DNL----VV-----
LPAPLFQQKLA-----KHFNVRVHGHDIESFITRHKKFANV----KEEYLE-----
YIFIEDITSK-----

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-MARAVDGNVI-----FVLKTLAVPADCRRR-----EDPRFVEAFA-----
PDELDAY-IREHPRCTLFETLRDEEAYSVVRVFFD-----VDL----
GAPLPAHELLPAFDGFIRALSRFVAN-----FAVDEC-----
AAPASRAALARALRADFSLTRSTNPGKTSFHLVFRNLYTTLDTLVAMKRPL-----
LALARRADN-----PLLRA---LDPAVFRRGASLRVVGTRKTPDSPHVHARTPPH----TRIQDY-
LFTFVDFSEKS-----CYFSL--RPRRDAP-----EPIAWDH-----QQLVPFADAM-----
RKVCQVLGNEILNLHEFTE---DNFTTTPLLLDY-VTPCAL-----CRK-
SAHKHPHHLALGNGALRIFKSGNPHSCR--LK-----VIPLEG-NRLFRTIAQRILDAN----
VINLTERGDYIVWL-----RNCWRFSGE-----ESVITKLVLMRDELAPE---
FALPLLCP-----RNRVIEHNLRDML--VDAVE-----
TDVFPEKLPFADGVLDIAD-----GSFHTGADAKDFMCTVSTGYRLERDARA-
RDALAPARAELERVLDIQRSPGNAENRALYKVLASCLCGATKPCIFFFFGETATGKSTTKLLQSAL
HGLFL-ETGQTILTDLMD-K-----GPNPFLANMHLKRAVFCSELPDFSCSGAKKIRADNVKRLTEPC-
LVGRPCYSNRINNKNHATIIIDTNYRPFVFDKVDNALMRRVGLVFRFRTHFSNRGAP-----A---
SRLYDT--VKPLDAALDRKIQSHYFRFAFLELLEWYQRHAAA-----LELEPTPDLI-
PDFCFQRRLD-----AVLLPSDSTHRRMLPQLAKLGYVLAGDDA-----LG-----
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GAQAEVVRLMRSNFSLTQSTDADRTSFHLIFPDAYTTMETLIAMKRPM-----
LEFARSSDN-----PLIKA---IDTAVYRHKATMRVVGTRKTPDDERVHRRQPPH----EDISDY-
LFTYVDLHENS-----CYFCLERRPEDALP-----DRM-WD-----PGYMAFKDAM-----
RRVTQVLVNEIVNLGEITE---DNFATTPLVIDY-VAPCAL-----CRK-
RSHKHPHQLSLGNGALRIFKAGNPHSCK--VK-----VIMIEG-NRLFTIAQRIVEAN----
VIHFTERGDYIVWM-----RGAWRFNTE-----EPSITKLVLGMRDSLPGE---
YGPDLLCP-----RKRKVVESNIRDML--VDPVD-----
TDTHADKLPFSNGVMDLPT-----GTFHTGDAAKEFLCTVSTGYRLPEQALA-
PESLSPALEELERIIDDIQPPTPENAENRALYERTLSSCLCGTTKPCLVFFFGETATGKSTTKRLLISAL
GGLYI-ETGQSILTEIMD-K-----GPNPFVANMHLKRAVFCSELPDFACSGAKKIRADNIKKLTEPC-
IVGRPCFSNRINNRNTHATIVIDTNYKPVFDRVDNALMRRVALVRFRTHFATSNDGGVAAAAAAK----
NEAYDD--VKPLDESLDRKIQRNYFRFAFLHLLVVRWYQRHHVPA-----LRLEATPDAV-
PDFAFQRRVG-----SLLIPSGSAHVPMPELAKLGYVLV-DGA----VG-----
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YIFIEDVASK-----

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NCVOG0031, unclassified DEAD/SNF2-like helicases

>ASFV_9628213

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ASKLFNITSKGEENFDVLSLFHRSDEAEDTLNENDISQFVQKISEAETNGLIRVNQKIMEQLRGGLLIA
DEIHNVYNIQERNNYGIALQYVLDAFP HQAPRAVFM SATPVTG SVM EYVDLLNLLVPRHEL PNGQP-
LQRQQLFDSSGHSVKWKDALALVERLSTGRVSFLLDNTNFYPERIFAG--
KMSYKDETLPYLHFIECPMSEYQLETLKQLGDPKISSNAYSIDMVFPNPKFSKQTEPKAYGLFNSTE
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IAFSKKDIQFPDIFKIIISHVPGDDNTLVGYATEDSVRLITSREDKTWHEIPLYMLNINVKRKENDIVIG
YMESK GKALKFKIRPPIQVLKNEITDIRMLNRGAVCETRGREEQKQIADQLGISLNLTKISA IKLCLLI
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-----WISKLYDS--LLLLNKNDKYNLNNIEFTTRSRLNEELLGTN-----
KNINDIITENIKKYDNYII-----IIDEAHNFFG----NASG----

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ELLIHIKQNSTARYVLLTGSPISNTIESLKDIVELLTNETFEYNKYIESAGNKVFQ-----
QRINKQGIELLKNKLTGLISYYDEDRKDI-PSPIFQGNIKLLNYP-----
VVLCPMSKQLQEDNYNMI---SNQTEN--DMFIKLMNVSLVALGDK-----ENYTNFDLL-
MASNKQIFPN-----FYVSNKGKFIGOELIDLN----ISSKLYFMNSILTSP--
NAGKRFIYFANSTI-GSTIIRSVMIANGISEYDKEIVNNFVCVNCLKER---
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NVFITDKINNIVFECFIEK-----IRRF CYTNNR-----
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TILSSDTIESDVLECFVLEK-----IRRYCYNTR-----
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IESSFVIENDIFGNCY-----LT--
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MIQCPMENIQEVDYDKT---REMSSN--EMFETMVNVSMCALGQIFLYKVDNFINNLA-----
TSLLPN-----LKSNDGLLTGQDLVTL-----
ISSKFYFMKYILTEGIEKPEKHLIYFSNATY-GTLIIRSIMLANGINEYKGANAKDPICFVCKHKK---
TC--VECLFITFTILTSR-----VNESI-
TPTLEVFNTRKNKHGHFISLLFASYALGQSYTLKEVKNLWFLTPDTYSQYTQIIGRAIRKFSYENP---
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LYYPWGNDEIITVPIQL-----
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GSLVIRNVMLSNGYSEFGGSQSNPHTTPDGRAK-----TFAIVTSK-----MKASL-
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VVYCPMPLQERDYINI---RKMCSN---EMFEKNMTNVSLAVLGQL-----
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ISSKLYFVRTIQRK---GKHFIYFSNSTY---GGFVIRNVMLSNGYSDYNGSRVSNPKMI-
DDRVK-----RFAVVTSK-----MKSSL-
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PFDIKKLMYLFKFT---KETLRIYSILQEI-----
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NGNLK-----TFAIVTSK-----MKASL-
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AGHPK-----TFAIVTSK-----LKASL-
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PFDIKKLLYLKFKT-----KETTRIYNILQDI-----
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ISSKFKFYIARIQSLT----GKHFIYFSNSTY-GGLIIKYIMLSNGYSEHNGSQGTNPKTI-
GGRLK-----TFAIVTSK-----MKSSL-
EELLAVYNSPANNDGSRIMFLFSSNIMSESYTLKEVMHIWFMTIPDTFSQYNQILGRSIRKFSYTNI----
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PFDIKKLLYLKFKT-----KETKRIYSILKDI-----
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NGKPK-----TFAIVTSK-----MKSSL-
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NGKPK-----TFAIVTSK-----MKSSL-
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LLEEQKLINFYARAQQVIKAYEGNRLTRGTLAVTSAMIKISPLVNIQINVRNVFDLFPATPDIPQLVVF
FYSKTGPTVVS KHHITSTEPEKFSNKTFRVPTIILIRFINKKAFI--
LTIQNNGHYFIESNWESENERHDFNSVSTLNNFINPIIHTINDMGPAAFPRGGSLPLPSNEDIQISISSM
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TFVEQDLEDLNTQTSRHTLSYGKKIPVNRI AFLPHQI ADELFLNTIKEPDI FCIVGVEQTMLGISNAGLF
YSLARILD LAPKALAI EIAKAANTPQYYILGNGAGNMFSSGAELANLILQTFVEQKNQLLQWDTTWQDIF
LDLVA--
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LFQKTD FQKITSVTEFYTKLSDFVDLNDIHTIKHILETTDAEHALKVLQKNIFNFDYTLLSPLQSYTYDE
LCQH LKLLTPRIEFYEDIETIDRGLINIYTS CQYSTLNQPQCKKKRLRIPVNHFENYIHILAADILNPL
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INDHVI-----LTFTLEQARGYIKNILGLSDDIILFSIWN-----
NFDYYLK---NGIFDPYNIQNMLLVEPNDDKSILYN-----

IYQNIVEGAVFCVTTNKNIGSQLARSNVYSSVYRDYISEIINNIYKNRY-----
---AMKSSIID-AMEYSINIDFQ-----
DLLR-----ISNIPDYNKT--LCISAYNNFYI-----KGNKITIL---DNFDS----
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TLFILGYSHIFNKVQSKA-----
KIKKIDEL-----
YPSRY-----
CQNYKD-----IKRQPILIDHIDES---
RLIKISDNF-----YTGKEDSTKTYQRKGTKKVYDPLKHGDVYI--
DSNGLKYQCSSIIY--YSNMGFL-----GNIYSATG--ICYP--
CCYSKPKIRDITFNT-----
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GRLILNPSNLS-----NLPYKLNLLLNSKNQIRIVKHTNRIILAKN-YTVIMAYQ-----
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VSIVDSNKINLIKKNFVNLNNITKEISENGIT-----
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NFDYYPD--NTIFDPYNIPNTLLIQTNPDKVLYS-----
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DLIK-----LSNLDNYKIT--YCISSSNKFYI-----KGTKITLI---EGLNM----
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KTRNIFIDL SNKINIMTSKDHISFRSYSINSDLCKYL-----
TLILGYSHIFNKIQHG-----
RIKKVNEL-----
YPVRY-----
CQNYKE-----IKRQPILIIENVNKE---
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DENGLIYQCASIY--YSNMGFL-----GNIYSASG--ICYP--
CCYSKPKTNDPTFLT-----
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RLKKIDEL-----
YPSRY-----
CQNYKD-----VKRQPVLIDSIDEN---
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RLKKIDEL-----
YPSRY-----
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NIDYSYVD--RQVFNPNIT-KTGLQKND--SLLYK-----LYPDCYD--
NLILWVVRSSDINDNDLGQ-----TGISWNM-EHEH-----
SLFECVKKVIPDFTITSFVN-----
NQFRTEITENKLRLITSKIQKYAES--LPTPRISVNF-----VTDKENIYITGNRLDC----
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FIMREYDYRRVTSEVVKVSLGSP-----NSSLPLGTDVN-----FLFEKT-
STNNIILTPDKKTNIIIAKNLITIKMKNFYKSLEKYF-----
TMMIVSYNHIHSPNFKSN-----
PFLGLKPY-----
YWSRI-----
CQNTIG-----
KNRKPLISSEISEQDQIDLIEQGTGF-----FKNKSS-----
DFYV--DEYTNVYKCGPDNDAYRYLGF-----KIFASING--KCIP--
CCFIQDQSSTPIYKK-----CIDKVD-
TKKAGYDLYILQY-----GK-
YILPDKIG-----FLKSRMDTLMNTKSKLVIEEETRRIKEAND-YSVIVTGKDSTG--
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NKVVLMYKSKLIYPENYHSLP-YTDYSYKVLIKSLLHNIREIKKSNDSDIEE--VYES-
INKRKIIADNPNPKISDEPIIKSHGME-----LKFVKFYVDGVLFSHSISSDY-----
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FLVIWAARAADTAFaelGSY-----DEVdKNILKFE-----
RLIGTFDQLNLFNSITSRFN-----NIFKTNIHATG----
LKRFIANNVD-----RRMLLL-----RSDEYFIKLSGNNFVL-----
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TFLIIFLNRVFNVSQVSK-----
DFTKIETI-----
YWSRI-----
CQNTKT-----KNRKPVVVGSldGD----
MDRVAENF-----YEGGGR-----EVFV--
NDHDVMFSCIDPHQRYMHLGFL-----NIFYKLSG--LCIP--
CCFLEAQKHSETFRA-----CVFKTL-

PLETCVSPYILNF-----GK-
ILTPTKIS-----FLPILYNMYFNKENAICFEVDNKRLRSTEG-YYVVKALDDS-----
VIHRLKTESNI----ISFVDA-----
SCSVMIVNDLVYYPSPDVDKIN----NRIHILIQEIVHEVVLVRKQLRSDRIA--FLEP---
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DFTKVETV-----
YWSRI-----
CQNTKT-----KNRKPVIVQSLDAD-----
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CCFLRSQAHTDTFKS-----CVYDEE-
VDRSALNPYILNF-----GK-
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SGNVLISGDMVYFPMRLADTA-----ATRILIQEIVHDVVRIRKDAATDAIH-----
LDQDASGRLASMFPHKAARRVREENGLS-----
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FLVIWVVKASDTNVRELGSY-----EEVDTNVLKFES-----
KLIEMFNDLDLNFVTKFN-----NIFRTNLKMTG-----
LRNLVLNND--KMLFI-----KSDEYFINLSGNHFVL-----
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VQMERIKSDITYKVSLLATPI-----TSKVKLDIETS-----FIFIET-
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DFTKIETI-----
YWSRI-----

CQNTKD-----KNRKPVIVSSLES-----
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LRNIVKRNQD-----NRILFI-----KTDEFFITMSGNHFVL-----
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LQMERIKGDITYRIFLLSPI-----TSKIKLDIETS-----FIFVET--
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TFLVIFINRMFNAVQAV-----
DFTKIETI-----
YWSRI-----
CQNRD-----KNRKPVIVSSLDAN-----
MERVSDNF-----FRSPTR-----EVFV--
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LDRQLVSPYVLNF-----GK--
IVTEAKIS-----FLPILFDQFFNEGLRIEF EADHKRLKATDG--YHVVKCCTRS-----
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EQNTLIAGDMVYFPMHGARSAGAEHQRVYILIQEIVHEVVMVQKAHDSRIR--FREL----
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FLVIWVARARDTVVPEFGSF-----EEVDPNILKFEA-----
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LREIVKRTQE--LEAG-HGVLLS-----RTDEFFIIMTGNRFVI-----
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PQMERIKGDITYKV LLETPI-----TSKIKLDIETS-----FIFVET--

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DFTKVETV-----
YWSRI-----
CQNTKQ-----KHRKPVIVSSTEEG----
MVRVSENF-----YRSDER-----EVFV--
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VDRSAINPYVLNF-----GK-
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SGGQLRSYFPYHARGEPIKSDSGLT-----
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DFTKVETV-----
YWSRI-----
CQNTNN-----KNRKPVIVSSLDED----
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DFTKVETV-----
YWSRI-----
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CCFLKNQSHTEFSS-----CVYQKE-
IASDVINPYILNF-----GK-
VVTTSKIS-----FLPIIFDSFFNEGKIIIFEQDNKRLKETIG- YHVIKSCDE-----
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LTTDGFLVDGKEFNVDLSSNY-----VAFTKNITTP--YTLSKY----FSPLF-----
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NCVOG0262, Poxvirus Late Transcription Factor VLTf3 like

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-----VLPRYY---RSVASARVPVA-----APADVCWFCAQAV-
LGGPLVVETMNG-----
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EEALAC-----
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VFKPISIETFKG-----
GEVGYFCSKICRDSLASMVKSHVALREEPKISLLPLVFYEDKEKVINTIN-----LLRDKDG VYGS-
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-----ILPKYY---KSVADVTLN-----ANTDYCWFCYQNL-
IIQPYFVETLKG-----
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CFYKENDKSIQISLRSL-----
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----MAKRVS L QDIVISSPK-SVIKPTR-----
DESLTC-----
-----ILPTY---NTVANVSIPVN-----TNTVTCWFCKQDL-
IVVPLRVETLKG-----
QVGYFCSRICRDSFAAMIKTHVALREEPKITLLPLVFYKPEEVINIIN-----SLRNKDG VYGS-
CFYKENDQSVQISLRSL-----

#####

filtered B22R-like protein alignment used for Figure 8 tree
#####

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>SGPV159

TIFLLIVPANANKPEFSLEKVESPKV-----
LQVPSVDVLDVLNKYDFDSVRPNVTDI-----
DYHGI-----LDQCTDETTEDRL-----
TLTSTKTIQQLVNQLPVSLKCFTK-----DITYKTNKNTTEITTI-----
KTEEYSGTFKNLQMDPDDFYFE-----
QMKIGGDGKTTELNKK-----
EDFMIKLIP----VYTPMNYSDPMFYHNR-----SSPILENVYD-
IWRYKKLYPF-----VMDIKI-
DKQSAH-----
NSDEYD-----

SDTDLYSIDQVSIDSKLEKSLNRPPELLSLFFEGLQTTG----
TGAVSRSAVGSIMSGAVGMAGYLGQAILLTQINQIP----PAPETPYQHQVFLSK--
TGQRHCNPAVPLTVYAGSS--LYNSNS----SMLTDTLQTIIVTVTTGSGIIND-
KIRVGCWNSMLKSLT--VSSNKILKDKTGAIHWHILNLDHHLRTHNILEFTCGAEPTLKF--
IGEPYQEVKIWR-----PTDTTGDSMRACTEHPKQIWNLAGCSLNVDTLQGHYTCGQLLAGSS--
KSDEKFILMTDI-VADSMVKIFEFDQN--QEFDMDFVHSKAARSYCKGGLVNGCVWPENLWKYNDK---
KKQRTFKVGLS---ADFSRFQFVCPSTNLRVINDTAGHIEWTVSETGQVDIF---
VDGIFSTISMECHDPDFVTDTRFFHKVS-----
GDEDVSTEVE-----
-----VTDYRVDWFKTHY---DPLYSDDKSKSSLK-----
VGGYTLKSSWRSNSGES-----
VCVIDDEQLECSG-----
VATNILTFFQKTDAPKVI STTFLFDMTFEKSNSHIMIPVEIQMKKL----ETLLTLGTSKFSEILNK-
AEFKQWPGQVYVTAQAIIDDFTQAEAEAYFKEVRDELVKLQKEVSHSLGSDPDM-----
CCYDNT--TTEFWK--DDWSCQLHCF---EKASVMWPVDLFDVFDIVKEIILKMIHMVELNSADEI--
MTHDVVTLTEIET-IQQIIDRLDVEHSVVP--YLCAIFV

>SGPV162

SFFTVCLFMSLV-----
SLDRLDPSVLQYVDDIDSVK-IQGYTT-----GIKWV---DTVCTNP--GPLF-
ESEFRDSSLDMLF----TVITQEA---VEKYISPKSDP-----EGLIRSEKFTN----
IGMELLGKVVALLDSYNCTHNHTTQIFSTYTAN-SQKPRVPNMVDDL SMQK-----RKSI----
NLCLVKNNGP-----ESPINSRTLKVHPDLTRNFASILFYFNGT---
IIEDVSEFEETGKEIRNTRELLDVTESRKDAMNM-----
TATEEVLRLYLQKD-----
KDMQLE-----PLDH-----
GGYVLKE-----

FFQASETSWRKDVWTHLKDNTDRNLKIASVVF GALSSVSGSTMVGGATMGPVVQIGGGILGVGQLGSTAI
TLFEMFKARPDVRDINTEFWVNYKQFIDSPAAGVRKCM--GGVNTHIQMAYRS--EMNDKA-----
WMDAPKSIVVIQKNVISHDMSNLFVECFSGKLRMTEGNIDAFSNLVSK--DGRQLYRV-
DYSGLSKWDRVSLTCGKEITLEIE--FTEAHDHMMFLPGSRTGDSQGSWTSMSDVCMTDPLKRIYTTL-
GCKYDLSTIRHETSCSLMYDMSVYDNIKHRFITVSGIDNNQTSVKVFFFPQG--

QNYTLDTTVDGQSKCLKVLDPDTCHWPEMVTVRNTY--PNKVRI FNVKLG-----
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DRDLFNQSQTIIKVGLDMYLPQM--
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TTS-----

-----P-----

TLNYS-----

CV-----

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YCL---QELVKPILPVYDPQEVFSLYAAVNRTFDYTFN-
ETFCLARHIATNGDVLWRYMDVAKMKTNTEDALEEDLKQ--NVFTLATLDVTNRLKA--
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LTRLDHETMLCFSGHHVGS--
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HSGTICSQFDNTCYWADSMILEDVTSNSRIRKHLVELAVSDKGYNSFVLNCPYGSTPFHI-
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GTPLDNFCYY-
WYLYWAPDYDPCASSMLGYSPVFLNKLKPPYIKEFGYNPGNEYVNRDLYNRLQHLVDNYNKLVMYSLD
PVEMSNEFAKSMTKEGREIFRLIADSKEIQTVRKENELKAKIRDEIEKTLNDIYVNTLTYSETELSSI
NTRCCVLNT--
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TDKVK-LMVSSIIILFENITIVNNTCIGTSIN---
IYAKTIVTTDPLSTTPPFLT KSFNCTLT LNTTNNITIQTEFKNLCNESSLETKVYAVGVPEKFNITILNSV
ESNSDSYFKIEDGNCEIDIMDATNNNEDSSKKSNTRHARSVHILDPFCLHMYHGDETIDSNKDMSTN
RRRSPGNLQSAEEMGARPKIRKQTQDVQIGARGVDGPVSGSEEIYSQVRKELSQLKSLVGLTTTRPKSTA
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NKINMIKTIAISSYLSSTNSRISSIMAQSNPKELTIVNIIVTSVLSQIGGTLAGG--
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KFFYHVFHILELLSYHPNVTFTCGNEPGVIFIPFEQKLSDMQLLRISTPGEPREAEAMSSDVCDIYPLKKF
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STRCCVLDT--
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KYNGI IYL TITNGNVTNMTYNDNATDYIN-IMESSTIIFS NITIMNNTCTIS IYSEVL-----
VIATSDPFSTSPPFMEKEINCSII MYTTNMSQYRDFINSCETSS IETKAYAVGVTNMFNEVLNSIENNT
DDYFCKIKNHSCGIGIISVITNYEIH--
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SNNIYEEIGEPYSL LNPKR SNPLPKSSKIDSSS INVKDIIDKSQKPLTE-
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--
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FS-
MPKRSKTCRVS ENTNCKNYH IKNIPEIEYNVKVIKLPVRLGIGYTGTLDYILERIDTYFTTPINIKID
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SPTDNFCYY-
WYAYWPPDYDPCASSMLGYSNIFAENRIVNPPYI KEFGYDTSNEYVNRDLYNKLQILYDKYNSLIMYSMD
PVVEMSNELAKSISKEGREIFRLILNSEEMRKTREENKIKAKVREDIEETLKDIYVNTLSYTEAELLSAI
NTRCCVLNT--
VVKYFPY EYLLCGYS DYIIHINNVS YVKINNTVIEEDIYRNIPQITCFKNILSIDNEENQRKFESQIVKT
ALEDAISDIFEDYDNITDNFRIENIRYKNR

original B22R-like protein alignment

>SGPV159

MLTLIFLLI V PANAWSNI-----SGKPEFSLEKTVESPD LKKG VVK-----
LQVPWSVDVLDV LNKY-----DFDSVRPNV-----TDQI-----
DLYHGI-----
-----LDQCTDETHEDRLL-----LFWSTLQTSTKT-
IQQLVNQLPV SLLK KCF TK-----

DITYKTNKNTTEITTI-----KTEEYSGTFTKANLQTS-MDDPDDFYKFE-----
QMKIIGGDPGKTTT WETLNKK-----

--EDFMFNIKLIP-----VYTPMNYSDPMFYHNR-----SSPILENVYD--
IWREYK KLY-----PAF-----
VMDAIEKI-----
DKAQSAH-----

GPLF-----ESEFRDSLLDHMLEF-----MTVSITQEA----
VEKYISPKNSDDP-----
-----EKINGLIRSEKFTN-----
IGMELL----GKVVA--LLDSYNCTHGMHTTK--QIQFSTYTLAN--SQKYPR----
VPNMTVDDRLSMTQLK-----RKSI-----
NLCLVKNN-----
GIP-----
ESPITDNSRTL---KVAHP-DLTRNFASILFYFNGT-----IIE-
DVSEFEETGKELIRNITRELL----DYVTE-SRNKDAMENM-----
TATEEL-----VLRQLRYV--
LKQKID-----

KDVMQIGLE-----

PLDH-----
GGYVSLKE-----

FFQASETSWRKDVWTHLKDNTGA--DRNLKIASVVFALSSVGSTMVIGG-AT-----
MGPVVQGIGGGILGVLGQLGSTAITLFEMFKARP--DVRDINTEFWVNYKQFIDSPA-AGVRKCM-
GGVDDNTHIQMAYRS--EMNDKA-----WMDAPKSIVVIQKNVISHDMSNLFVECF-
SGKLRMTEGNIDAFSNLVMK--DGRQLRYV-DYSGLSKWDRVSLTCGKEITLEIE-
FTEAHDHMMFLPGSRTGDSQGSWTSMSDVCMTDPLKRIGYTTL-
GCKYDPLSTIRHETSCSLMYDMSVYDNIKHRFITVSGIFDNNQTSVKVFEFFPGQ----
QNYTLDTTVDGQSKCLKVLNDPDTCHWPEMVTVRNTY--PNKVRI FNVKLGPD-----
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ARTEVAMVKMNKFTVSTVVDVDFGENMISLRSGNNTWKDMVLSVYGCPGKSEEDGKCTHLM--
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LYGIISDVISGTQLLGNGME-----
CMAGIKSMVNTLS-----GIKADNVET-----MIRNQIKTKCG-----
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VTVATCVLLTLVFLVVLVVSICKSKKNTLVNHS-----
-----E----SQVKL-----
LT-----
KSTASSMS-----
SESSISGNKSMVTV-----

GNAHNYNLN-----EIITRHPEFKPARKYRRVSGPSLTVKSLTY-----
LNCQKPINKTQQE-----ARKRTRRALLTVVDHTDETMLCAFQSGHHGEVGSDC-----
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PGTSGELIYSEINHHAIDTKARVDTAVTNVL-----
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QSSDVVYSSLE-----GTASGGRI-----VTGYQA-----GGST-----
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DVYEEPPRYNARRDI-----DINERLTSHARDNNHMTTTSACGRRFKRDANAMCM--
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SKMARTRGANS-
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TYMPIKPNSDPQHKLCSNA-----

IKVS-----
TTS-----

P-----
TLNYS-----

-----C-----
V-----

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FDPDFIRK-----DDLKRAYVRARIILDAEKVAVYLNKTEVVVEKAV-----
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ESIQGDYDNLILLDNIQRVITFNVGT-IPTGGKGLP-NIITECILKTKEYAND-----
TCPENKLWFTSDD-----IYRESRNLRTK-----
TSIAEVSPMPKTTKAPKTTTIVSMTINCTTPTNCTNCTAD-----
CPNSYPNETVPEEVTVD-----YDCL-----QVEL----VKPIALPVTYDPEQDEIVFSL-----
YAAVNRTFDYT-----VGKFNW-ETFCLARHI-----
KAITNGDVYLTMYPYWRYMFDVAKY-----MKTN-----
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LALVISSKLYLDTIVAVSSAEKTA VSTLAVIQEMFDPYY-----TFRTVE-----RHKSLITN--
GNAHNYNLN-----EII TRHPEFKPARKYRRVSGPSLTVKSLTY-----
LNCQKPINKTQQE-----ARKRTRALLTVVDHTDETMLCAFQSGHHGEVGSDC-----
THHNRRKRGLWD---RIKNG-----NSGAGQPPVDR TLK PGRVAVG-----
PGTSGELIYSEINHHA AIDTKARVDTAVTNVL-----
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QSSDVVYSSLE-----GTASGGRI-----VTGYQAGGSTYSMAGYG-----
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DAL SASKWYEEQIFHIQKK--C-----CVLSL NDA--PSGSEQPW-SLF--VEALDP-
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EKQFNKTLYEQI-----
-----FERESVIELRKL-----ENAVEYG---
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FDYKFRQGVTRGYSENLTYL RPMN-----QTFYTSPPPG---DDYCALVRFNYTIMI---
ESIQGDYDNELILLDNIQRVITFNV TG-IPTGGKGLP-NIITECILKTKEYAND-----
TCPENKLWFTSDD-----IYRESRNLRTK-----
TSIAEVPSPMKTTKAPKTTTIVSMTINCTTPTNCTNCTAD-----
CPNSYPNETVPEEVTVD-----YDCL-----QVEL---VKPIALPVTYDPEQDEIVFSL-----
YAAVNRTFDYT-----VGKFNW-ETFCLARHI-----
KAITNGDVYLTMPYPWRYMFDVAKY-----MKTN-----
TEDASLLEEDL-----KQ-NVFTLATLDVTNRLKA-----DFFEMFKESH CNTWED-
LALVISSKLYLDTIVAVSSAEKTAVSTLAVIQEMFDPYTF---RTVERH-----KSQLITN---
GNAHNYNLN-----EIITRHPEFKPARKYRRVSGPSLTVKSLTY-----
LNCQKPINKTQQE-----ARKRTRRALLTVVDHTDETMLCAFQSGHHGEVGSDC-----
THHNRKRGLWD-----RIKGNNGSAGQPPPVDRTLKPGRVAVG-----
PGTSGELIYSEINHHA AIDTKARVDTAVTNVL-----
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TENGFMMVFG-----

N

GPGSKA-----AETCLKSGSGSSNIF-----SYNGQGGNLIVAMNA-
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ISEGAVYDSDDKPCPISLQ---DRENLT--LPNSFYSNVSSARLD---LNSSIDYFWCR-
INGTGGE-----TDLFFEISNRSRQMIYLFHG-----GNVSDDV-----
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FPFRS-----TTKE-----

CEASISIKDRLLTVVCKAYSIRIGIWSRE-----LCVALTTSVNHCN--SDEEAVMK-----
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LIIDRNALALKRKHAEEHSEMEC-----CILDPAK--TSKKAFDD-GFY--LCAGYE-
SFVYLD-----PDEGTRYLMVNDSELEDGYIWMN-----ESVSCVELIMLMVGEDE-----
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-----IEE---AVETL-----FK---EYD---
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-----LINNTI-----
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-----IVESCKT-----
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ENNPDC----SNYVSLAADTAVQATKILSSYM----YTKGNRHKRDT-----
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SARFRSACENTST-----
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DCPATMQGLELSVHEGSVTLTLVSGLVSSVNPVF-----P-----SENATRCLMAVPT-----
KITYNGS-----
CENIPLSTPTSMPEGTPPGASADTLKNTTESTPGNASADERPLASTPAPLSTPASFFATTLEISSGTRA--
-----VTVAWNLA STPT-----
LTPASMSFEEQ-----
HVWWTNLTVEDNCTIMVGIQVKSSAQ SACERADMETV----LAVVG--VLTEYTEALHRLNLSS--
DNETKDYECM-M-LGSPSCFLQGLRQVALHNVMQNLQAKALT-----
RARTRSLHDD-----NAHCLHRHF----
GMGPGVDHCENIEEPLARVRRSDPPRPTPPRVRRRPRGGVDTPQRPLPKPRPGGGSTPPIPPTKPKSLV
EKVSESL---GM-KP-VIGPGVQEVQLGAHGS---D-G-----SVVG-SDGLTTSLREQ-
LRKAVEQRA-----PTLPT-DMNPDDLEKARIRW-----REGGGH-----LQGLCSEA--
VRYKEESIRSAAGKAHDWSKRKHRWGQRRGFHGTGRGGGHGDESDL-----
EDVEQVRQQLKEM-----
GIGPLGRQRSSGSSDLEDVEEVQRQLKEMGIGPLGKRKSSSSSNSDFEHLQD-----
-TQQQLVKKGLFRGGRQSG-----PTRFDES VWKKLDQLGGPAHAPVFSPQVHGSP-----
PGDVVAPLETR-MSGDPGHLDVHSSG-----RHT-----PTFP-----
NLDTGTRVSA-----ETTYAVLG-----GGGG-----
PRPPRRLRERQREGGDGVGDYAELDWGEQRHAGRRRHGRGVQDGSGLPPIPGEKSP TGRQLGDRPLPP
TPTSRHEDSPGTRLG-----RKICKRSLD SLLCGMLGTRPDSDSVPHDPV--
YESVQGPYSLLGEHNRPPATN----PNYREPVYSTLGMPTGPEAPSKTGG----
GPSAPPELMPADTSSPRMKQLA-RE----ENRLEKFLSAV---SLSTYLSSAQTQLREVMMVQPHM--
PHGMAVATMISSIVSTAGGTLALAG--A-----
SNPVTAAGLALQGVGMLIDIGTSLYLLIKGQSRPPPVDPVTEKFSTYARHMAQAS-AGARLCLMPDS--
DLRLTLAYRHS--HFESAAGE---KGALAFADTPMTLVYYLRSQYIVYNTRVTVTCP-
IGTLRLLEGDISAYAVLESVGE-
DGASHYALPGIMELLSNHPNASFTCGSEVGARFVPFDRELGDMQLLRVAAPGEPKETESIPSNVCDLFPL
KRF-YLLTDGCPHDRSQTAITIYVTCGTLRLMASWEPVRNRWVLLNPFRRSADEFIQLF-TFSQYDF--
SGSTIRLHELDAPEAFCSQR-VSSTCYWPEPMMLEDVT-ACETRIRKIHVELA----TVGGSGY-
TSFVLTCPPGSTPFH-----V-----SNVSVVAIPQNTRRTAVRY---AAT-TQTS-
ILVSCVHNTNPAYKSDIVVLTFSTQ-GLRS-RFSDMEKWT--QRKMLFDSSA--WA--
MPLRSRTCKRPEENTLC-----HLAYSVSQQR---AEYHLQVQTL P-EQRLHEYH-
GELDALTQLTRTHFASDL-HLRVDVSFLASAY-----R-TPENLW-
KHAAKQMRTFSAITITLYPCASMVGMDI-----KYEQ--VLARLLYL--GTKDHGNGQN-
LTFHALNSLNSRH-----
ARHGHELHADYSCRAHLDIPEKTVSLHCPPLSLPKAPFNDTGVDG-----ICVVVTSSRDHCA--
VQSEEGVR-----EGYTSYEAETPFLSCGA-----YVQEYA---VRENFCYYERTLRIPLAH--
DYDPCSTAMVLGYAHVWLETRLVS-PPYVQ-EFGYDPS-RNEYANRSLFE--
QLQDLQRQYEELLKSSNPAVRMANQ-----
LAATLTEEARAI FRINADSQLMQTAFEADEERLRELEARIENTMQDIFL-
NTMSYQELDALRRSAFSTR--C-----CVLDGT-----SVRKYFPL-EHY--LCGNYG-
DYIV-----TAGEYRFL LINHTLVDEAYNATE-----QPWLTCYEITLVPVSTEEQ-----
RARVEEALFLDA-----

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TTTQNYENVIIANAMLLESKI-----NWTIIMSEV-----
NETFAQNCSNSD-----
YLYNGRINETFILTFQSGYVDAYHELLFVEPTS-----FEMPTN-----
MSIKYANCTNYTTPPATPTPGYGNDSDTTQLRL-----S-----FNESSMIITFN-----
NITVVL-----NNTCITTSIE-RVHI-----RLDNDSLIVIATSYP-
FSTSPPFIEKEYFNCTLTLPVFIQQ-----
GSKFEKESNCTVDYDATTNDTLI-----NSTACVNTTFD-----
STKNITYVYNNETRVLIEQQN-DLFTNITVITEFLNECNASSPETK-----LYAVG--
IPNVYNEILTNLSVEI--TNDTVTYFNCK-L-IGTGDC-----GVGIFLERATTMILEEKAKAK-----
AKSNSRHARSV-----IDLDDAFCLHMRH-----GLHHDVD-
CRSRLIPEEKPKPK-----ERSRRSPPKGEKPPVPPK-----NDLVLMSADEL----
GA-RP-KIRRNDDTIQMGASGV-----DGPVAG-SDQIYTDVKQR-LETRIKKLAIDDKSCVLTA-
SRLPPSTKALLEEVIGRKAISTKASKDITLQ-----ILNQQQGI--TGNPMDRLF-----
KVDVQTHTRPSTIINVDTSSRVYANILR-----
TPKNVEVSVSKGVTVVETT VYGSRDDTYLKPRRSSMSDSDS-----
TYFLQPEDEEV-----FGTSTQHMNKRRPLRRHSSSDYETIKERQRSV-----
EENYYESVNDHNLALAGRPTTPRRPNPREGVPLPPIPRKDLPLPPIPG-----
NENPFNTKTKKMID-----KICDSQG-----
SASICDIR-----
SSDLLYESVVYDETNRQLKHNPIYEPFNELEYSANPLY-----
-----QPLEESKPKSGLTRKNAIRRRPGQGSDTVIIIE--
TRYSEGPEQGNNDYDANDVKHSDWRVSNYSAEPRKGNNDGGGTNTAKDG-----
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NGGKYYLVHGILELLSYHPTVTFTCGNEPGVIFTPFEQKLKDMQLLRISTPGEPKEAEDMPSNVCDLYPL
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KDSLINLNEIGYSDTVCSQS-DTGTCYWS DAMILEDVT-VCTSRIRKLYVKLS----TSLGKGY-
NSFVLTCPYGSTPFY-----I-----SNGTIVDIPINTRRTTVRF---AAQ-SDTT-
ALVSCIHNTNAAKSDIIQLTFVTE-DTQS-NYLDFRYFK--YRRRLFETFS-----
DPMPLRSKCKRYEENRRCRN---Y-YHV--KHIPK---IDYKVMQRLP-MVKLSTSYT-
GPLNDKTITKISSYASPI-SLSIDVSSLSNVY-----D-VPHHFW-
KYAKEGVRTFSAIAVTMFGCSVVAGNVV-----NPGIGTNSDV--YGRNAKYIFLGTKQSPSNNR-
IAFDVYDSYYQTT-----
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LVAENWDR-----YGYSYSEAYTEFDSCRN-----EYYPTR---PIDNFCYY---
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KLQTLYEQYNKLVESMNPVGVISNN-----
LAAAMTPEAREIFRLEYSGSEMEMEITLNKRKAEKVKGEIEDLLSDIYA-
NTLTYSEATAMLRSAISTR--C-----CVLNGT-----GVYKYFKL-EHY--LCGAYD-
DYLI-----RIDNKTYVRINETIIPENEYLTTK-----IPRVTCFHTDLIPITDEET-----
QRRFEKMIIQTA-----
-----LED-----ALTSI-----FE--EHD---

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NNSYIHNIAGGLTVVC-----

MIIATYTFSKLRTKQKKGNYNVRNKIVDPIQEIQLDGIQYY-----

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TMTQNYENVIIANAMLLESKI-----NWTVMIMSEV-----
NETFVQNCSSPD-----
YLYNGRINETFILTFQRGYVDADHELLFVEPTSLDEMPNTNVSV-----VY-----
KNDTGNTITTSAPPTTAPTPTPEVSNDTTQLRLS-----F-----NESSMIITFN-----
NITVVL-----NNTCITTSVE-RVRV--RLVNS-----LIVSATSYP-
FSTSPPFMEKEYFDNCTLTLPVSIHQ-----
GSKFEEQRVEESNCTVEYNVTDYNSTADNNTSVNATTGLNYTCMTNTTF-----
DPTKNITYVYNNETRVVLEEQN-DLFTNITITIDFLNECNASSMETK----IYAVG--
IPNVYNEILTNLSEI--TNDTVTYFNCK-L-MGTGDC---GLGIFLERATTMILEEKTKSK-----
TKSSSRHARSV-----VDLEDAFCLHMRH-----GLHHDVD-
CRSRLIPEEEPTQPTR-----TRNRRSPPKGEKPPVPPK-----SDLVLSAEEL---
GA-RP-KIRKNTDTIQLGASGT-----DGPVSG-SDQIYADLKQK-IETRLKKLIDE--GGLTA-
SRLPPSTKALLEEAIGR-----KARSVQ-----VSKDITRQ--
IIDQQGATGDPISGRQFKVNVRTQTRPSTTVTVDTSAGVYANVLR-----
TPKDVEVTAPKDVTVVKTTVYGGRRDDTYFLEPRRSSASSESPYFLEPRRSSASDVG-----
SASPYFLQPGDEDVFGQEYAQVN----KRRLPSDGVHNPLRRHSSSDYETIKERQRSIKYH-----
RENYYESVDDSNLYALAGRPTPRRPNREGVPLPPIPRKDL----PLPP-----
IPGNDFNTKTKKID-----KICDSQG-----
AASICGIR-----
GTDALYESVDDVDTRHLKRNPIYEPFNEREYSTNPLYQ-----
-----PLEEGAKPKSALTRKNAIRRRPGQDSDTLVIE--
TRYSEGPEPGNDNYAANNVKN-----
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AYENNMNSMIKAI--ALSSYLSTNSRISSIMASAGSQ--
PKELAIVNIIVSSVLSQIGGTIAIAG-----SNSPTAAAAGLALQGISGLIDAATSIYYILAGLQ--
PYKDPAIEKFSNYANYMSRTE-AGARVCMMPDS--DITITLAYRHS--KMNTDA-E---
KNRGEYTDVIPSKVYLLKNNYISYTVKVTLVCP-IGQLRLLLEADVNTYSTLIREEN-
NGAKYYLVHGILELLSYHSTVFTFCNEPGVIFTPFEQKLRDMQLLRISTPGEPKEAEDMPSNVCDLYPL
KRF-YVLAGNCPYDMSRKSVAIVTCTLLRMSTYEATKRWILMNPFESEHDNIQLF-TFKKYDF--
KGSVINLNEIGHSDTVCSQS-DTSTCYWSDAMILEDVT-ACTSRIRKLYVKLS-----TSLGKGY-
NSFVLTCPYGSTPFY-----I-----SNGTIVDIPINTRRTTVRF---TAQ-SDTT-
ALVSCIHNTNPAYKSDIIQLSFVTE-DARS-NYLDFRYFK--YRQKLFNVFS--DP--

-----IIYNNETIDLS-----
QYYNNTERNIYNETIDLSKYNDTEETIIYVQRNRSKLNLCDSASMETK----VQSIG--
IIDVYNQTLVNMSSIIP--NNETAAYYLCV-L-SGTNNC----GIDIFVEAASKYILEEENQ-----
KQSKNRRKRSI-----NMELDEFCLHRNY-----
DLTSLEDCTNTNINNKAIIVVKNI-----RKRRSPPGNNNKPPVPSK-----
GNLVLQSADEL---GA-RP-KIRSRVKNIQVGAHGT-----DGSVSG-SEEIYSNVKSE-
ISEKIKRMVITSKGDLTPE--ERLPSSTRALIGSVIQSKIDTV---SESEHI-----TKQLIEKQ--
KPDATYAVP-----
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NRGDTLIKTKNRHVRIYEEEDTYFLRGRLSSSGSEEDTYFMRRTPSSSSDDTY----
FLKESDNRVSPSTTYSPLNPKIRNPSSSSSTY--
NLAGLPQQNRNPSSLTIDLGLPSRKNKNHPPENYYESIDDEHVYESINDP-
VYSLAGNPKKHVDRSTL-----PVPP-----
LPNENKKKKMID-----MICESKS-----
RSSICNVR-----
NFEESLYESIDDDQFSKRNSLYDTTGFKRNSLYDTAGGDHFSKRN-----
-----SIYESIDDDVIYNDLSGHQSLVRKNAMKKTKKQ--
LNTQNEEFVITVKEDGNNDMD-----NMDINNNNNNNNHGNNN-----
NNKRKEKTKNKLNELS-VY----DNKMDKIVKTI---ALSTYLSSTNTRISSIMAQAHTQ--
PKELTIVNIISSVLTQLGGTLAGG-----AGSPKAAVAGLALQGIAGLIDAATSIYFLLSGEE--
PPKDPAIEKFSNYASYVSQTD-AGARVCMMPDS--DITITLAYRHN--NMNNEA-E---
KVRGEYTDITPSKVYYLRNNQISYTVKITLVCP-IGQLRLEADVNNYATLLREDK-
NGVKYYLVHGILELLSYHPNVTFTCGNEPGVIFMPFDQSLSDMQLLRISTPGEPYSAREMPSNVCDLYPL
KKF-YVLAGNCPYDMSRISVTVTCNTLLRMSTYDYEKNRWILMNPFSRTNEDIYQLF-
TFSKYDFSSKSDTINLNTIGHSGTICSQF-DTNTCYWADSMILEDVT-SCNSRIRKLHVELA-----
VVSDKGY-NSFVLNCPYGSTPFH-----I-----SNGSIEIPMNRTRTSVRF---LSQ-
SENV-ALISCIHNSNPIYKSDIITFKKS-DMSS-KYLDKFNFN--DRKYLFDSEFS-----
DIMPKRSKTCKRYSENKCKN---Y-YQI--KHHPE---IDYKVVVVKTP-MVRLTTSYS-
GPLNEYTLANIRNYSSPI-QINLDVSSLSNVY-----K-NPDHFW-
TFALKNKRTFSSIVVTLFPCSVVAGNIDV----NYGIHSGKNYDR--YGRNGKYMFIGSKDSPSNKR-
INFNFVKDHINSKL-----
ENEFKGDVHLDLESRLVKVSCPEFTIPQRPFDSDNSINS-----LCVLVTTSRDHCA-
ISEEAWSKNDRTHGYGYSYEESNMEFNVCVN-----GKGTRKPLDNFCYY---
WYLGTYWAPDYDPCASSMVLGYSPVFLNKLVK-PPYIK-EFGYNPG-NEYVNRDLYN--
RLQHLYDNYNKLVMYSLDPVVEMSNE-----
FAKSMTKEGREIFRLIADSKEIQTVRKENELKAEKIRDEIEKTLNDIYV-
NLTLYSETTELLRSSINTR--C-----CVLNGT----DVYKYFTL-EYY--LCGTYD-
DYRI-----NVDNKTYIKINNTLIEEDIYLALK-----IPQVTCFQISLISVNNEES-----
QKNFETEIVRLA-----
-----FED-----VLNDL-----FK--EID---
NNKTLYFI-----SFENERR-----
NVNKINEIDKNLILSIS-----
ISLAITVVSTIAIIL-----
IIKRSKYKMGSYNINTTQKPLNNSSLKNTYVSLIDFDEIYYKINN-----

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TKRQDFDVLKANKAMALEQKI-----NWTMLKEEV-----
NDLFKKNCTSDSN-----
TIYNGILSEITFEINHGFFNVDTEVSISKSLLYMDLGVENYSD-----VLESYNI-----
TISNMTTMTPTPATVITTPLYLENKNNTNDIKV-----K-----LYMVNSSIILTFE-----
NITIVI-----NNTCIGTSIN-----SIYAKITSD-----FITINVTTDP-
LSTTPPFLTksMFDNCTLTLPVTISQEGYYTKEYNEHTGTTESFTYSYSDNMNMTESFTTAFSYSDDTT
TEPLTTSDYLYNTTLEPSFTTSRYLLNNGTSNYKNISYVYNNKTCIVFVKQNNIFKNITIQTEFKNLGN
ESSLETK----VYAVG--VPEKFNTILKNISVEK--SNDSYFICKMI-EDGGNC----
EIDIFMDAATNNINDELSSK-----KGSNTRHARSV-----
DHIELDPFCLHMYH-----GIDETIDCSLKKNNKDMSKHTNRI-----
RRSPDPKGGKQPVTK-----GNLQMSAEEM---GA-RP-
KIRKQTQDVQIGARGV-----DGPVSG-SEEIYSQVRKE-LSQKLKSLVLDLDD-GKLTT-
TRLPKSTKALIGGLVDSKIET----SSAAYD-----ITRQIVHQ--QSGDIYSLP----
VKNKVFVGVESNRKITSPIIDVDTSSNIYANVLQ-----
KRDFKITS PKNV DVYEKTRTDSFSDSYFLKRSFSSSDDTYFLKESDDSDSDIFR-----
-----RSSKKDQTYSLAGKPLKKQSLRRYSSSDYETI-----
GENIYESIREP-EYALLSKPRVLNPRSHI-----PIPS-----
LPKDEIPFTQQKRKVID-----MICDSRF-----ASSICNAR---GLDLA-----
NYRGDSNIYKTTDDDFVKRENSLYARSKLEPELKDNPYESLSNIDIVSNPYN-----
-----NPKLSRRNAIKKKVLNDGYDEFVIRTDEEPSE--
KPNMATNTYNNNDKANNKDN-----KGFSYLNNDIQEDEKNVNI-----
KKSKKGRTRKLSKLS-TD----NKINMIKTI---AISSYLSSTNSRISSIMAQSNQ--
PKELTIVNIVTSVLSQIGGTLAMAG-----SGSPKAAAAGLVIQGISGLIDAATSIFLLSGQE--
QPKDPAIEKFSNYASYVSKTD-AGARVCMMPDS--DITITLAYRHS--NMNVEA-E----
KTRGEYTDIIPSTVYYLKNSQISYTVKVTLVCP-IGQLRLLLEADINTYATLTREDK-
DGVKFYHVFGEILELLSYHPNVTFTCGNEPGVIFIPFEQKLSDMQLLRISTPGEPREAEAMSSDVCDIYPL
KKF-YVLAGNCPFDMRSKSVAYVTCSTLLRMSTYEHEKQRWILMNPFSNNNEDNIQLF-
TFKKYDFSAEKDKIKLNSISHSDTICSQS-DTSTCFWADAMILEDVT-SCNSRIRKLSVEMS----
TVSEKGY--NNFVLTCPYGSTPFY-----I-----SNGSIISIPMNTRRTSVRF---ASK-
HNNV-ALISCIHNSNPAYKSDIVEVMFKQS-NMSD-MYLDKFYFK--DRKYLFDSEFS----
DIMPKRKTCKRASENSNCKN---Y-YYI--KHVPE---IEFKVHVAKLP-MVRLGTSYS-
GVLNYQTLEKVNKYFSTPI-SISVDASTLSNVY-----K-NQEHFW-
KFAMEKKRTFSSITATIFACSVVAGKVVV-----NMGVKGSHDY--YGRSGKYIYMGSKDFASNDK-
IYFNFI----PDKA-----
EYRLKDTYGECEIYLDLKTTRRVNVCPELTIPQHPFDSLVDNS-----LCVLVATSRDHCA-
ISEENWRSYDRTHGVGYSHEYVDAEFDSCSK-----NHGPTY---PVDNFCFY---
WSAGIYWPPDYDPCASSMVLGYSPIFTENRIVN-PPYIK-EFGYEPE-KNEYVKRELYN--
KLONLYEKYNMLVLYSMNPVVEMSNG-----
LAKSMTSEAREIFRLIANSNEMQKAKEENDMKAEKVKMEIEETLNNIYV-
DTLSYSESTSLRSAISTR--C-----CVLDGT-----SVYKYFDL-EYY--LCGNYS-
DYLI-----NINNVTYVKINDSLIEEDIYLVN-----IPQVTCFDITLVPINNEEQ----
QKKFETEIVTMA-----

Supplemental Figure Legends

FIG S1 Multiple protein alignment used to prepare the Figure 3 tree.

FIG S2 Multiple protein alignment used to prepare the Figure 8 tree.