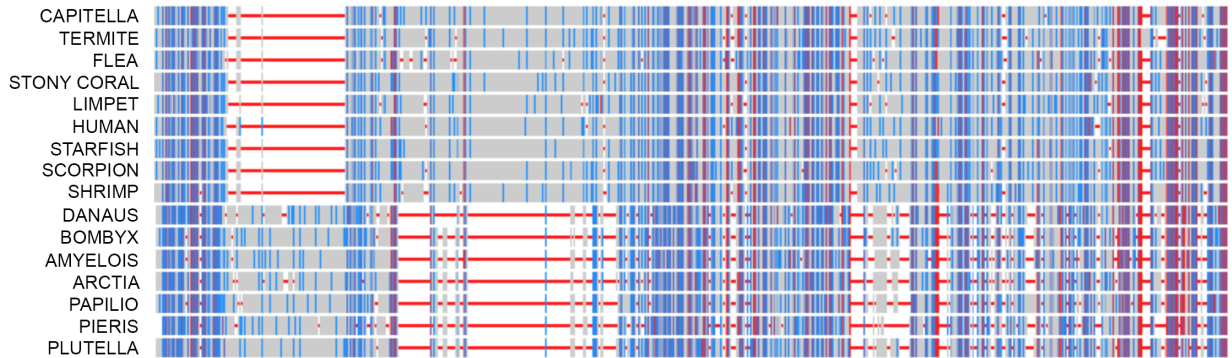


Supplementary Figure 8: COBALT Alignment of DNA-PKcs sequences from selected Metazoans with clear DNA-PKcs orthologues (Capitella, termite, flea, stony coral, limpet, human, starfish scorpion and shrimp) with examples of Lepidoptera Danaus (*Danaus plexippus*, butterfly), Bombyx (*Bombyx mori*, silkworm), Amyelois (*Amyelois transitella*, moth), Arctia (*Arctia plantaginis*, moth), Papilio (*Papilio polytes*, butterfly), Pieris, (*Pieris rapae*, Butterfly) and Plutella (*Plutella xylostella*, Moth). See Supplementary Table 1 for complete taxonomy.



Supplementary Figure 8 Lepidoptera

CAPITELLA	759	LEIGRSLPLARTSLNLTLESWSKSLPPDVMKPFYEQLLPYLDAYLTS [1] ADEKNDTSLVQKDPMKKQGK [5] KLLKQT	838
TERMITE	728	FRVGRSMLPLARLGLSALDKWYCTLPShLVTPLLMQVLPYLDPPFLRS [4] SGQDVIIEKELMVLGRRNRN	804
FLEA	681	FKLGYNHLTALASLALETLETRWTDHLSKEQNTILLDEVLSCLPEYLOQS [4] GDDPV---KVCLITD-----	747
STONYCORAL	773	FKLGLSYTPLAEAGLDALESWTTALPADKLPFLREILQCLDGYLTT [6] HNECNTIV-LITSSHHTSRGR [4] KLLKMK	855
LIMPET	742	LTGLSLYPLAGIADALEYWCHNLDPHIVKPHYSCILPYLDNYIRT	817
HUMAN	756	FKLGLSYTPLAEVGLNALEEWSIYIDRHVMQPYKIDILPCLDGYLKT [3] SDETKNWVSVALSRAAQKF [5] KHLK-K	836
STARFISH	775	FQGLSLYPLAETGLEALERWMLHLLPDSLQPHLKVILPPLDGYLR- [5] GSDAADVVQVTVMASASSSGR [8] KLIK-G	859
SCORPION	755	LQGLSLYPLAMSCLDALETWLYSLPSELLKHEYCKLPSLNDYFLA	835
SHRIMP	746	LQGVSYLPLAEVGLLALQWLTKSLSQEILSEHMPHVLPLLLPYLRS [3] GGEAEVHTRVITVKMAFARQR [5] KMKKES	827
DANAUS	918	-----	920
BOMBYX	1014	-----TNAPDVWFSVLPINEITTT-----	1037
AMELOIS	1019	-----LDSYEHWLTNLPNIQD-----	1042
ARCTIA	1007	-----NMSYDNWCKKLNLETVTE-----	1030
PAPILIO	1016	-----IMNFKLWCKEFEIDKIAI-----	1039
PIERIS	940	-----YEASENWLKQNLCEVAR-----	963
PLUTELLA	1089	-----IDNFGTWCXKHLPLKRVTN-----	1112
CAPITELLA	839	MFDAE-- [2] KESELKEIQRCVLLLGLSLGGSINHALVF-G-QTANPPDLVAWD--SDQHLKFDLPFLDIKTSIYFDAFL	911
TERMITE	805	KVARKKI [3] PESELSQLQHEIISFLGQLDSTTCLALLK-D--PQEEEDVIPWAtcLQQPLVFPPLPFKDMKLNINLEKLI	881
FLEA	748	KKVKKQI [3] TPSELALLQRDIITFLIGKLSMDCSSLIS-KnISNHYDHLIPWD--LKQHLFRFLPCQGVKPLIYLDKLL	824
STONYCORAL	856	PQSQH-- [2] TLTPLAKVRHKILRMFGGLGGETNILLID-NtGINSSN-AVVWD--TENHLTFAVPPQDMKPSIYLDPFL	928
LIMPET	818	FSSFSSTI [8] YESKLGVIKDRVVQYLGSLGGSINYTLT-TNsQDDISKQAIAWD--TEQHLRFETPFIDMKPIIYDFPF	899
HUMAN	837	TKNLS-- [2] EASISLEEIRIRVVQMLGSLGGQTNKLLTvtTsSDEMMSYVAWD--REKRLSFVAVPFREMKPVIPLDVFL	911
STARFISH	860	ASTTG-- [2] QDSPLRSVQLRILHLGLSLGGQTNAYLLE-TsAEEIAKVAVAWD--TQPRLQFAVPPVDMKPNIDLDRYL	933
SCORPION	836	KIKQTDL HESSELKQVHRILRFLGSGVGNQYNAFIS-AdKIKIHEVAVAWDinKQNHKFLYLPFIDVKLEIFLDFKL	911
SHRIMP	828	KRVEETA ---MQIQLMILRLIGSLDGLLRHLHTIP-QpDPTIASAAVRWVv---QKLVKATPFPHIKIDYLDL	897
DANAUS	921	LNDTNDT -----VRSARVITTEACDGS-----	942
BOMBYX	1038	LLDEHKA -----VIKSLNIMLMV--FE-----	1057
AMELOIS	1043	YYDN---VKSLLNIYLNITEFY-----	1060
ARCTIA	1031	NMAD---ILGTLDVDSEIC--Q-----	1047
PAPILIO	1040	FEDIN--L IKSLKILLNIFDKN-----	1059
PIERIS	964	FNTERWE -----VVQGVVGMKIKAT--G-----	983
PLUTELLA	1113	FVSDDAI -----IYALKKMLKI--FN-----	1132
CAPITELLA	912	PKVVTLATVSSDRQTKVAACEHLLHSLVLLMLGRSASQP---TGNPMAAIRKLPQMLKATDVEQVSRQLFEPLMLQI	987
TERMITE	882	PRVVELAMTSSDRYTRFTACELLHGIVMLILGSGQEAQ--TSHPKYSELFRKLSLPLKLGCDPDAIHRLLYNLLVLQ	959
FLEA	825	PRINKVLDSNDRQTRIAACEHLLHGIVLYILGTGMQVNV--TA---QLVHLYTNIFPTLLQLAADSDI IAMQLFDPLMIQI	899
STONYCORAL	929	PRVVELAAKSSDRQTKVAACEHLLHSLVHVMGKSVTQP-gGFKKSPMEHLWKHVFPPTLLQLACDVEQVSEQLFKPLVQL	1007
LIMPET	900	PHVVELASTSSDRQTKVAACEHLLHSLVCLGRGAQQPgeVQKRYPMQKLYKLLFPAMLLKACDVEQVAKQLFEPLTMQL	979
HUMAN	912	PRVTEALATASDRQTKVAACEHLLHSMVMFLGKATQMPegGQAPPYQLYKRTFPVLLRLACDVDQVTRQLYEPLVMQL	991
STARFISH	934	PRVVELALATSGDRQTKVAACEHLLHSLVFLMGLKGTQQPegROAKSPMQLHYRRVFPALFRLSCDVEQVAKQLFEPLVMQL	1013
SCORPION	912	PRIVTSLTASDRQTKVAACEHLLHSLVFLMGLKGTQQPegLQAIYSMKKLYKNVLPALLQLACDVEQVAKQLFEPLVMQL	991
SHRIMP	898	PHVVDLAVNSSDRQTKVAACEHLLHSIIILMIGTGAQKSeTQLKEPMAPLYRHIFSAMLRLACDPPDHVTRQLFVTLSTYQT	977
DANAUS		-----	
BOMBYX		-----	
AMELOIS		-----	
ARCTIA		-----	
PAPILIO		-----	
PIERIS		-----	
PLUTELLA		-----	
CAPITELLA	988	IHWFTKSNNSHRPDEALLNSLMDGIVSPSDSAVRDFSACIREFLAWSIKQTSpKEMEAGPANPKRLLKRMYSLLEHPS	1067
TERMITE	960	VHWYSSKFLKKSKEVEIILIQTLMDGITHPDTALRDFSARCLHEFVWVSVKQ-----SHVN IKYVMKQIYSPCLHPC	1032
FLEA	900	THWFSQWKIKSIETSLLDQMLGTSNETSASVRDISAKYLNFEVWVSLRQAdpEDLRSSSVNLEALISKICDYSINSS	979
STONYCORAL	1008	IHWFTNNRKYETPETMALLDAIVDGI VHPVDTSLRDFSAQCIKEFLQWSIKQSeKQLEKSPINIKSLKRLYSLALHPS	1087
LIMPET	900	IHWFTNNKMGESSETMALLDTIFDSIIQADDTSLRDFSGKCLREFLHWSLKQSSvKTVEKSPVNASSILRRIFSPALHPS	1059
HUMAN	992	IHWFTNNKPFESQDTVALLEAILDGI VDPVDTSLRDFCGRCIREFLKWSIKQITpQQQEKSPVNTKSLFKRLYSLALHPS	1071
STARFISH	1014	IHWFTGNKPFESSETTALLNAMLDGVIHPDTSLRDFSACCLKEFLKWSIKQTSkKQEKSPINTKSLKRLYSMALHPS	1093
SCORPION	992	IHWFTTKRMINSDETKQFVQVIWDGLVQSKDAVDRDFSARCLKEFLQWSIKQTSvREQENP IGMNVLLNCLYNSLHPS	1071
SHRIMP	978	IHWFTNNRNFENVDTMVLLEALMEGIVTANDPALRDVSAQCLAEFVKWSRKQC--RQQNSVSSNIKSI IKRIFSPCKHPS	1055
DANAUS		-----	
BOMBYX		-----	
AMELOIS		-----	
ARCTIA		-----	
PAPILIO		-----	
PIERIS		-----	
PLUTELLA		-----	
CAPITELLA	1068	SMMRLGGALMFSNIYSVFREEDALVDQFSLQILSVLVNSLALAHRDDKSLGTQEQQCSALLHVERILIKKQVTFNKDSKQ	1147
TERMITE	1033	PSKRLGAALVLSNVTYVLEEEESVNVQFWLELLYHVMNLSLEETDSILGGQEVVAVNHIERVLKEKASLFNKEDNI	1112
FLEA	980	VHKQLGAALTFNNLYMIFRENDNIVDQFWIQLSTYFVQSLMVNKDHTNI---QQLEETLNHLMRVLVEKSDLFNDRSGH	1055
STONYCORAL	1088	ASKRLGAALAFNNIYTVFREESLVDIFVLEILVNYLECLSLSHGDEEARGTQEQQVQVI IHLERI IHSRAQLLVKENHR	1167
LIMPET	1060	VFKRLGAALAFNNIYQIFREESLVDYRTFQILVHFVESLSLAHKDDKSLGTQEQQCAAVLKHQLRI I I FHEDILKPKSKI	1139
HUMAN	1072	AFKRLGASLAFNNIYREFREESLVEQVFVFEALVIYMESLALAHADKSLGTIQCCDAIDHLRCRIIEKKHVS LNKA-K	1150
STARFISH	1094	SFKRLGAALTFNNIYTVFREEDSLIDQFVCEILVTVFVNSLALAHDDKSLGTQHLGVEVNLHLERIIRVKADMLNKESKI	1173
SCORPION	1072	PFKRLGAALAFNNIYTVFREESLVDKFTLEIAVHFIESLAI AHYDDKILGTQDKCKQALNHLERIMEVKAKLSKTSKK	1151
SHRIMP	1056	AFKRLGGALAWNSIYREIREDDQAVDIWTLDDLALHMTSLDLAQVDDPALGTHEQTKSAINHIERIIRVKSDFLQKSKSQ	1135
DANAUS		-----	
BOMBYX		-----	
AMELOIS		-----	
ARCTIA		-----	
PAPILIO		-----	
PIERIS		-----	
PLUTELLA		-----	

Supplementary Figure 8 Lepidoptera

CAPITELLA	1148	RIKPRGW---RDANMTTAVRWLLRQCGRPQTECRHVCMLRVQCLAPCVHEINGARELFSVLLSQGNSEYFIQRFEFGMY [5]	1228
TERMITE	1113	RRKPPPEF---EGILLKDAVSWLLKCGTVQVCECRHKMELVYVLAPELLPVCKSGSEFVSWYAATHSWTSIIRICEGSKE [2]	1190
FLEA	1056	RNI PQVL---NGCLLKHVVTWLFKHCGFVENHCRKCKEMFLKLAVLVDEINTAHMFMQNTGNFVIKSVIEIGECSTN [2]	1133
STONYCORAL	1168	RRIPRGFasqSSITLHMIPLVKQCGRPSSECRHQCMRLISKLAPLLPGVNSAADWMKKT-HEDHPSSFVHRFEGGG- [5]	1249
LIMPET	1140	RQEPREW---SNKTLDIAVRWLSRQCGRPQTECRHTCMKLVYNL---CTHVQGNVYFVSPDLIDIVDKSTI IKKVFEGGGT [6]	1219
HUMAN	1151	RRLPRGFpAsLCLLDLVKWLHAHCGRPQTECRHKSIELFYKFPVLLPGNRSPLNLWLDKVLKEEGVSFLINTFEGGGC [4]	1233
STARFISH	1174	RRIPREFpagVCPTRLSMLVIVLLRQCGRQTECRHQCMILYKITPPLPGHNTPQTMQNTLKEKGPDYFVSRFEGGGV [6]	1258
SCORPION	1152	RRRLRNT---NDSILPEVVEWILKNCGCLQTECRHKMELVQLAPCLSGFNCGKDYFSLHLETKGKFFLNCFESEMS	1227
SHRIMP	1136	RRLPPGF---GGDTLVDLKWLFEQCGRPALVRHTCMELLASLAPQVKGASVRDFIEKYVVGISKLSSEIVDILEGGGE [3]	1214
DANAUS		-----	
BOMBYX		-----	
AMEYLOIS		-----	
ARCTIA		-----	
PAPILIO		-----	
PIERIS		-----	
PLUTELLA		-----	
CAPITELLA	1229	GLN---QKPTMSRVQEE-NFSLNAACTWFDLVLATLDCYTWWFGERLMSPNQILIASN [3] TTIIFQVLHFFMEELAQEDISA	1305
TERMITE	1191	GIT--VTPTLKHLRN-EVALVYVVRWLRMLVTSFDCYVNLFGELVKPSVLWGTEG [6] TRIFEAAYFIIQHVCHRDASS	1270
FLEA	1134	GLN---SKPTLEHLKQTEPIFGDILKWMKNLYASLDFYVWLFENTLFTPTTLFS--- [4] SKILVTIQYFINNIVNIDPAD	1209
STONYCORAL	1250	GIE---QYPTLAHIGG-HFSLKETILWFEFVLAALDCYTWSFSEHLLSPSWVFTSSE [5] SVLLVSLKFFLHSLAMFGITE	1328
LIMPET	1220	GIS---ACSTLLKISD-TFTLTSTMNWFDMLLAGLDCYTWWFGEDELLTPIINIFSGTG [3] SKLFESLEYFLSNISLRSIDE	1296
HUMAN	1234	GIL---AQPTLLYLRCG-PFSLQATLCLWLDLLAALCEYNTF IGERTV GALQVLGTEA [1] SLLKAVAFFLESIAMHDI IA	1308
STARFISH	1259	GIS---KYPTLSMTCG-PFSVLACSWFDLLAALCEYNTF IGERTV GALQVLGTEA [1] SLLKAVAFFLESIAMHDI IA	1305
SCORPION	1228	-----NTVPSFNQ-NDGLKPIINWLEGLHMLDCYTWWFGEDELLTPIINIFSGTG [3] SKLFESLEYFLSNISLRSIDE	1299
SHRIMP	1215	GISyvkNPTASSKHI-GSSLDKINIFLEALSASLDGVCWLIQGGIVPAKLLNHSE [1] -QLFSATYTFINEMALLTVESE	1290
DANAUS	943	-----ILS-----	945
BOMBYX	1058	-----LRS-----	1060
AMEYLOIS	1061	-----LHS-----	1063
ARCTIA	1048	-----KIQ-----	1050
PAPILIO	1060	-----VEN-----	1062
PIERIS	984	-----VKS-----	986
PLUTELLA	1133	-----LQK-----	1135
CAPITELLA	1306	AVKLFPPKVDAG [3] FTPREREDYNQTKCTVIVRTLFSICTMFGnYKTESLKV IPTSFWSNLDWTLTLLAVLQPTQLGFNM	1385
TERMITE	1271	VTCLLSFDTKD [3] ITPWEAESFDRTKCFVTIRLLDMISTVL---KSGEAGCLPHSLLNL-QLWQLIVACVLHPGSLGFDL	1347
FLEA	1210	LPAFL--DASV [3] ISIKDKEKFIKFNFTFIMILTFVSKIL--FCDDADELITSFSLNRLSNVNVNCLFCPQDLHFN	1285
STONYCORAL	1299	ATSCFTSGSPSR [5] FTPKEIDDYFRAKCTVIVRVLNFLTILLGqDFPQETLKTLPPEFWSDELFEVVLSCVLEPVGVFNM	1410
LIMPET	1327	VSKLFKE--SS [3] FTPREIEDFNRNKCTVIVRINFLSVLIGkYPKDAIKVLPGTVWSDTLWELLKCVVQPSVGFNM	1374
HUMAN	1309	AEKCFGTGAAG [2] TSPQEGERYNSKCTVVVIMEFTTLLNtSP-EGWKLKDKLNCNTHLMRVLVQTLCEPASIGFNI	1386
STARFISH	1336	AARIEYXGSK [7] FTPRESEYNEKCTVIVRVLWDFLTVLLenYASDAVKVIPKSIWQDSLFDLVVTCLLQPTVVGFNM	1419
SCORPION	1300	VQAFFTHESVK [3] FSPKEKDEYLRNLNCFIIVRLINFTTIVenYHLQ-LNTIPSTFWSINFWNCIYSSVLNPKLGFDM	1378
SHRIMP	1291	YMKNHDAFQNA [1] ATPYETEATAKLKCTVIVRLLDFVSVVlqGPKVASLLSQHSVWSATMFSLLTCTLPDASVGFDI	1368
DANAUS	946	-----KDEFIVS-----w-----	954
BOMBYX	1061	-----DLIKT-----w-----	1066
AMEYLOIS	1064	-----FMNKLA-----LW-----	1071
ARCTIA	1051	-----ALNILADVFDH-----	1061
PAPILIO	1063	-----DLIKEI-----KIw-----	1071
PIERIS	987	-----DVVGEAVN-----w-----	996
PLUTELLA	1136	-----ITSLLPETCELIQRW-----	1151
CAPITELLA	1386	GQVEVMNHLPEQTLGLTLQILMRsLPRNLAQELIESVSRHLNMSS-cDLSSKLP-IPLEP [2] DYIQLRLLVSGFEQL--	1460
TERMITE	1348	YNTVEVTDGLPKNLIQLLGVLQETLPSSQLLEELNSELGRAVSSMQ-tDVLSNLQ-DLSLRND [1] VTLEQRQLLKGLEIL-	1421
FLEA	1286	ENNYIGQNYLIKLNFIENLRQyKNDTYHYHQIEGSII EKLNECT-heYFNETE-vNFNSV [1] LSVAKNNCLNASSIck	1361
STONYCORAL	1411	GDVEVVEKLEPEQTVGLCKLLVQRLSGCEBLERKGLLEKIALGShcNLPDQLPFLPSNPQ [4] DCLRLAYLVQGYQQL--	1489
LIMPET	1375	GDVEVMNHLPESE---VPTKLMFVGTITNFS-----DLFSLTnLSLNNP [2] GHTVLQHLVSGYIILL-	1431
HUMAN	1387	GDVQVMAHLPDVCVNLMKALKM---SPYKDILETHLREKITAQS---IEELCaVNLYGP [4] DRSRLAAVVSACKQL--	1458
STARFISH	1420	ADVEIMNHLPKTRKLLRMLSThLPANLRNLSKAVTRSRVTKSShhdLTKLLQsMFGRDE [4] DHGKLIHLVKGYEQL--	1498
SCORPION	1379	TDTYIFNQFPKTRKLLRVFYEyMPKPLYNFNHLYEYL--ESKcNIYNLFP-LNLNDK [2] KILEIQEMLLGYEQL--	1452
SHRIMP	1369	KDTEVSKHPLSRLEELIGILARrGPSEVIEGYSdVLEKQLQKPE-ndI IKMLP-LSLSET [2] INLRSHVIEGIGIL--	1443
DANAUS	955	-----KDMFNSFLDPSHLRMCLETS-----w-----SEGL--	978
BOMBYX	1067	-----PDSIMKV---TPKKS---D-----LEYYI--	1083
AMEYLOIS	1072	-----PKRVMRK---YLEGATGTE-----LSFL--	1091
ARCTIA	1062	-----PISYSRVWMDILLEKENQIR-----HVI A--	1085
PAPILIO	1072	-----LPLIVEKHQNGIKKRF-----IPYF--	1091
PIERIS	997	-----AKAVREIYDAGIERYA---PH-----KPYL--	1018
PLUTELLA	1152	-----PKELLLFKSNYIQDFLKS---PAEYKGLLLECQE-----MAYL--	1175
CAPITELLA	1461	NSAGLNLNTLVSKSseK [4] LVNVTV-----FMGMVTAVD- [2] PTLvNLSPV--SQSLAEKMLTLAFQMGYPEKNLVE	1530
TERMITE	1422	HKCGMLSHIVKELP--N [4] DGNQIVkh--LFSALVEGQGD [1] KRTvVLQPA--AFSyaESLLKFAPLLNKEVTVIE	1493
FLEA	1362	HSYVTRSKFWSSLA--N --GQYITn--IYNGLIEENTD [1] DTKIGIFPEhVINYGKILSVIFEHVDCDKLLIE	1429
STONYCORAL	1490	HCAGLLLPALKAKA-rN [4] YAVKLFt--AVYDGVKPSLNV [2] QTV--ILDPA--SQHLASKLLDLAYDLGLQPNYLM	1562
LIMPET	1432	NKTGLLVNTNV---qQ [4] TVYKVCYpQFFLGMNIPVSV [12] KKIiTLTPA--ASILGKSLDLSPFKLGDKNVLT	1514
HUMAN	1459	HRAGLLHNLPSQS--td [4] VGTELLS--LVYKGIAPGDER [3] PSL-DLS---CKQLASGLLELAFAGGLCERLVS	1530
STARFISH	1499	HQANLISAATTHG--sg [2] FAVKLFi--TVFDSLTSDEA [3] LQA--NLTP--SVELAESLDDLAFLLGIEAKMLVS	1570
SCORPION	1453	IENKLPKQCNCS-- [2] LACDMLS--SVWESCILETEI [3] IPI--LNPS--VLNFGKMLTVALKLDISSEDLK	1521
SHRIMP	1444	EKSGWLAKCNVVSy--S [4] LVDWLCG--SIFKEQNLVSVG ---iSPHPS--LLKFLYTVMQLAITLDPKVKHLL	1511
DANAUS	979	-----TDLTYVALTYMD-----DVEIKNILTR-----	1000
BOMBYX	1084	-----SSALSASLKASS-----RDDIKRLI-----	1103
AMEYLOIS	1092	-----TDCLTAAVKVTG-----FNVKSVLL-----	1111
ARCTIA	1086	-----SDMLSIAEKCLS-----CSEFEDVL-----	1105
PAPILIO	1092	-----TDLHLHIFKFLP-----TPDIRVVI-----	1112
PIERIS	1019	-----MDVLCVALPALN-----IQEFELFDD-----	1040
PLUTELLA	1176	-----TDVLAALSINFLK-----PAEYKGLLLECQE-----	1200

Supplementary Figure 8 *Lepidoptera*

CAPITELLA	1531	LIFNSNNIHHVSTSVQCSPH--	GtLfYAAFPKSVVNLFVKSVEKVPVLLMRHLEANGET-LSSVLIGIADH-----	1598
TERMITE	1494	CIKQASIQNPATHSSVSLHGDI[1]	---FFVTFRSAIILBHMILACFEHVSCLIKDISANNVQwVISTVTEILQYYAKIRRS	1568
FLEA	1430	SVLNDVHIIGNITESKLAHQ[1]	---FYSIFGNQI IKYLMRFPIDAVKTTITNDLGASPIKRHIIVDFLIQIILIYIRN	1504
STONYCORAL	1563	SIMEDS---NDNPSSCGCT--	---FYRIFQTSINGFFIERANIHMANILMKAASSPFL-VLSLNLGILDQVIRDKIL	1631
LIMPET	1515	ALLNDDMIQKTPSVNLQ-H-	GeAFFLMFKSVICQYIAENGRITIPILTNQAKTHGRK-VNSILGATVDYIARDRTL	1588
HUMAN	1531	LLLNPAVLSTASLGSSQGSVI[4]	GeYFYSLSFSETINTELLKLNLDLAVLELMQSSVDNTKM-VSAVLNGMLDQSFRRAN	1610
STARFISH	1571	CLLDKALFSGRSTSSKGAV--	---FYTFKTLNGEMAVQAQKVIPLLVREGGKDVTV-VSSVLNGLLDYLTSSREV	1642
SCORPION	1522	KLLDEQQLVYSNLKTKTRRGL	--IMFSTYQQEISLFAKINSKHFISLMMNINKSKTT-VLKILVGLDSIGKVKF	1595
SHRIMP	1512	SWATNSDTSVSGTSGQEVKGS[1]	---VLSILGPKLIPQFLLESPPDALSRCVEMIREGRFLpAMGFASALLTCLIRNADI	1586
DANAUS	1001	-----GPGGE[1]	GlfKFASLSVFPFLNAA--LLE---SCSLLLYD-----VVRYANR	1042
BOMBYX	1104	-----GGDGRDL	---CRRHVVKVFGFLVKSPSVLLDGDVTSAYSLLD-----DVVDCYVRMRC	1155
AMEYOIS	1112	-----EGKSADL[1]	GvKFCGQPMRVFLNSFLKKPVLMDDDVGGDCCVLD-----VVVRFCVWRKCP	1168
ARCTIA	1106	-----EKNE	--DFVLKYLRYVFERIL----LTEGVVNTNLPFIE-----VLKYFCINYKKY	1150
PAPILIO	1113	-----L[1]G-	FVSDTFMPVVFHLLVMN-----FDLVKILHQ-----RDVMKVLVKYSKI	1153
PIERIS	1041	-----DvNFCKWAPVALVYIE	QNRKTPPLPKKSQIAELLPL-----DVMKVLVKYSKI	1077
PLUTELLA	1201	-----NGSNEKD-	GlKFCRFVKS FAGYFLES-NILMDVEMKGLCVLIH-----DVVKHFGRLES	1254
CAPITELLA	1599	---G---KMVSRAIVSQ	SSLSVWVWSEstAsLDTKMVAITLLTKLMQIDST-viIDVKNSFYVVF	1670
TERMITE	1569	KHQDSttICAFERSIVNH	NKLSFSV-EG--NSEQVQVLLGLLVNVARIMPQ---PDRGLARCEALQ	1642
FLEA	1505	EKENEFllSISSETMLNH	NDIVQHVBTES--DAVDLVTYLGIIVPVSNV-----GPNYLAEW	1572
STONYCORAL	1632	RTRNG---SSFVAVLLNN	TSEFIFWRTH--sAMDLRHSILMILKMLLDLPA-kvTDCNRLFPSP	1706
LIMPET	1589	RKKEG---PNVASTILSE	KKFSTWWTNN--aPELQNLAISSLTQVLLIDSR-vtSHTSHSPSST	1663
HUMAN	1611	QRHG---LKLATTIQQH	KKCDSSWAKD--sPLETKMVAIALLAKILQIDSS-vsFNTSHGSPFEV	1685
STARFISH	1643	RRTHG---MSVHSAITQD	DILMGLKKG--sPDLQGSFALLMLRLKLQIDAK-fvSDTTHPVFSSV	1717
SCORPION	1596	RRYG---KDIINSIMCQ	SRLQQCLEES--cDIDLQNDIITLTIKMLIDSS--fIKGNVYDSN	1670
SHRIMP	1587	RKYS---KVVQSFLLKH	PTLAQAQGT--SLHQDSVLLSSFLDIDREgtiKSHCTSSRDMV	1660
DANAUS	1043	RGRRG---EVEDVIQI	PHYEKIATNK-----QQQFFME--CLPGV-----RSEDVVY	1100
BOMBYX	1156	ERWRG---DVLNLVDGL	PVYEQQTEFS-----KQALLVLSLRFVP-----PPPTSPPV	1214
AMEYOIS	1169	EAVYE---QLLLDVDEV	PVYDSDTDFN-----QKCQLLNMMSCLFP-----LSRDSNP	1228
ARCTIA	1151	EKHYD---RLLYLVEKI	PNPFE-QLDFE-----VKLLVASELLRLPRS-----VGLISP	1209
PAPILIO	1154	ENY---DVLVDVQLE	PEFEKVSFTE-----QQYLLLEVFSFLPNK-----LLPESK	1212
PIERIS	1078	---FCK---APVEFLDRP	ADFESENSTFE-----EKIEVALVIGAGEAC-----LWAERIV	1127
PLUTELLA	1255	GVICR---KVVETVDQM	PTLESQTLTE-----QICALSDDLQFLDTS-----DLQLSSNP	1314
CAPITELLA	1671	LQFKTRVLDLLIFFCNLPAB	--ENKQLESCLNQFVADCFPMSLEFhagsQQKCYITALDRLLAMELS	1748
TERMITE	1643	LHYKSRALDILLVCLAGPQED	--TNQELRSALQTLREHPFLQSTELHSGSVYSGFVNAFRKILRGL	1720
FLEA	1573	LDTKSKVLDVLPFTITGPKDI	--ENPELQALKTfQSLHFPLESKEFREGS IERASYSAFSALLNSL	1650
STONYCORAL	1707	LAFKQVLELLPYFTKSTEE	--YLRRLEKGLNAPFVNNIPKLSSTEFVTGGPQYNDVYVQTI	1784
LIMPET	1664	LAFKMKVLDLPPFPAMAQET	--YITKLSLDRFVADNFPKISNEFTKGSPRYQYDILSIAL	1741
HUMAN	1686	LHLKQAVTLLPFFTSLTGG	--SLEELRRVLEQLIIVAHFPMQSRFPPGTPRFNNVDMCKF	1763
STARFISH	1718	LTFFKQVMDLVLFFFTSLPGD	--EQTKLRALDRVADNPLNSSEFRVGSFKYIDYAGALNKILTA	1795
SCORPION	1671	LEFKICVLDLPPFF--LCDA	--FLCKVQAAHLNLDFTNHPFLYSSELKPGSSQYNDYHLAFT	1746
SHRIMP	1661	LQAKTKVILKLLPFFPFMGED	--IAKSVSEALEMLSNHPFLHSTFESEGGARDREYHQAICEIL	1738
DANAUS	1101	LETKMMIDLVLPK-----	SLP LLEF--PLPSRLSEL-----RGSLANCFRALLDALAT	1158
BOMBYX	1215	IQRTCLVAGL-----	pAGEEYSAAYSSP--SGVVGPRLEA-----ARGRGPALRAL	1276
AMEYOIS	1229	TENSRLMELL-----	pGGEFADCYATFASNTLSPRAGC-----GRA---ALRAAL	1289
ARCTIA	1210	LDHKLRLM TIL-----	pGGSEYSSCYRSM--ACTLP IHLSEM-----GGDHAGVLR	1272
PAPILIO	1213	CEMKTKLIGLL-----	pPGEAYKSTWSY--VGLLPARLSEA-----QGESGLLL	1274
PIERIS	1128	PLHMILQLLPLQSDMRRRA	-----STALSSA---GVTGAGGA-----CAKEGVAVA	1191
PLUTELLA	1315	NDDKVRMLAVLLVLLKNDVGS	dvQEKYNVALQSY--ATTLVLRSS-----LTAHAPAVSALL	1385
CAPITELLA	1749	SVICKEVQKHT	HENAIQSAFQRFIKRL--PKDKHKLALDVPYKIFsQEGRF	1823
TERMITE	1721	AMAASESQHV	LEDOIQSLSQIFIKRL--EDKQVQAIEAVFKVFDVDDQYDP	1794
FLEA	1651	SIIAADDLHI	CEDEIQEKLCRTIENC--APENQFNLRIPYFQI-KSREYTP	1724
STONYCORAL	1785	AIFCERERQH	HEDOIQQSFIAFIQRLHPDQKAAAMDVCLISIFNERDYQ	1861
LIMPET	1742	SIFCRESKHV	YEDEIQDVIARYTKRL--VIYQKALDLIPYKIFtSSGSVY	1816
HUMAN	1764	EVLCREQQHV	MEELFOSSPFRRIARRG--sCVTQV--GLLESVYEMF	1838
STARFISH	1796	SIMCRDEKHA	YEDEIQSLLAAFIKRL--pEEKQT--AAFVAYQIQENSP	1870
SCORPION	1747	QIMCRESTHL	LEENIQKCLKLKCKRT--DSNKERLAEVPLKMFLEDEL	1821
SHRIMP	1739	NLFCREDKHR	YEVVMHESLEKFMKKL--PLLQQEFLKHIYDMYnDPT	1813
DANAUS	1159	TLAATDPTPG[1]	WDSALDSCMSKLARTE-----HRGSWQAIYDTC-----	1223
BOMBYX	1277	ALAAGDDTKG[1]	WDEAIDSCMAAVAKHR-----DVTVHETIYAWT-----	1342
AMEYOIS	1290	ALAHTDDEDS[5]	WEAALDACSASLARSD-----NFKACDILLES-----	1359
ARCTIA	1273	TLAAADDTKG[1]	WDDAIDASMSSVADRR-----DENIYDAAYQTM-----	1338
PAPILIO	1275	QLIAGETASG[1]	WDDAIDASMVSLSKRN-----DMSVYGTLYAYC-----	1340
PIERIS	1192	TLADDETCG[1]	FEAALSQWARNANAANA-----CAADLTLRHELCE-----	1257
PLUTELLA	1386	ALPLSPPLPA[1]	LSTALRTECAASISTHA-----G--TLHAVRELCE-----	1449
CAPITELLA	1824	FYCEHIKEIMKI	---EAKPKAPEHAFEAQTSKIGCFELLEVMSRLPNTD	1901
TERMITE	1795	FYRHCIQDLQGL	---NVTLDRCRGLQTEHQVGRIGANNILEPLVHLESSE	1871
FLEA	1725	FYKNFEEFNNL	IESPYTSASRANLDKQAYVDRTCFFHLITILVY	1803
STONYCORAL	1862	FYQDIQQLMSVL	---EAKELKPTDPNPFESQVTSKLCFCFLVLI	1938
LIMPET	1817	FFLTHISFIMSEI	---EAKLVKGSKAELNQLTTKIGCFQMLBLLYSRL	1893
HUMAN	1839	FFSTIVDAIDVL	---KSRTKLNSTFPDTQITKKMGYKILDVMYSRL	1915
STARFISH	1871	FFKECIKNIGGI	---DAKTIKAPETVFNQVSKTCCFQVLELMYSRL	1946
SCORPION	1822	FFIDIHEIMQIV	---KSKRKSSNE---IQLVSKIAGFLIILTYLSKE	1886
SHRIMP	1814	FLLTVISAVMAGM	---SAPVHGRSDPQHKLTVT-KVGSFMLIQIMYSK	1888
DANAUS	1243	FASPLPEFLRL	---RQR-PRGSDTRVNKRLTEQTRAFNILEIIFQ	1299
BOMBYX	1324	FISNVNMLIDML	---MTG-RAASNALAYEQGVNYTRALSVLAVAF	1416
AMEYOIS	1360	FFARNLNSLRL	---ARK-PRDCISVKHQCVQVTRALMLLQLAF	1435
ARCTIA	1339	YASKIIPDLSLE	---KTGFEPTNTEVFRRVERVYKAFSLIQMI	1411
PAPILIO	1341	FFSLKLDLLVL	---KTLRFSVYNSPTCQVYVNYIRALVLLRVCI	1418
PIERIS	1258	LMSQVSNRLIRAI	---RVKPRPGDRRALIRCLNDYVRRALLLTIA	1331
PLUTELLA	1450	FFCACMNSILSDL	---WPK-SKSSNNF---IQYAFALAQAF	1517

Supplementary Figure 8 Lepidoptera

CAPITELLA	1902	TKVSNATK-GE---NMNGETLLIPLRRALHCAAYNTLIAAL-ICTQKEKFFYTAFLFTENPAKNQLHWNINVDQDVVYE	1975
TERMITE	1872	TSRAYKYR-SEtLHDNLtGNVQLVELFRQSQCAAFNTLVAII-SNVKCELRFPTGLLFSENKAK-EVWPGLVNCNKEYA	1948
FLEA	1804	TRKAFKAR-TFmNYD---ENDTESAEELFRQYQCTAYKTCLILI-CSTKSDLKFFYTGLLFRENPLKKEIWRNIIDCKRIYE	1879
STONYCORAL	1939	TKAARAA-IE---DMRGETVALELRQFHCAAYNALVALI-CCTQTDLKFYVAFVLFSENPIKGLLDDNLVDCNRTYE	2012
LIMPET	1894	TKCAHEAR-SE---DTRGETELVELRRQYHCTAYNLMSII-SCTQTEAKFYVNCFLFSEKPSKQGLLDDNLDCMKPE	1967
HUMAN	1916	IKLCYDAF-TE---NMAGENQLLERRRLYHCAAYNCAISVI-CCVFNELKFYQGFVLFSEKPEKNLLIFENLIDLKRRYV	1989
STARFISH	1947	TKACHAAR-SE---DIRGETNALERLRQFHCAAFNTLVAII-SCTQTDIKFYNAFLFSENTAKQGLLDDNLIDITKNYS	2020
SCORPION	1887	TGFATAAR-KE---NLGESISKEFCRKYCCAAAYNAVAIAI-CCTQTDKSFYSTFLFQENFAKGEYIWEINIIDLKNLEYT	1960
SHRIMP	1889	FRYAAKIS-KG---ELRHDTQTHAELRRLCAAYNAIYAVL-ACVQNDLRFYTNFLFSANPTKGEVIEWELVDCSRNEI	1962
DANAUS	1300	CKLVCATR-----TQYDKTGVDEYRFLQLANFACLSALLCREPRAP-VYSCVF-----DVKVWSELVSEVSAA	1364
BOMBYX	1417	CKLCVTL--RdaVTCPEGAGGGLRGACRAFVVAAYKCLTAAL-CR-WKQPKAYVTLF-----DEKALSNLMDPEKRYE	1485
AMEYLOIS	1436	CKLCVTL--RgdARAPHVT---LACYNYRQCAIYNCLCAAI-CKSSPADKFFYDFIT-----GPEAWGKIIDACGPYD	1501
ARCTIA	1412	C1YSMTL--RtkVRCPDNASAAQLDACLRLQTSAYNCLTAAI-CKRRPSQKQYAAVF-----DMSAWTKIVDPHVHQD	1481
PAPILIO	1419	SMLCNDLIPqNrrrKIPNLGFDSTIKNCLLFYCCAYNALSVAIwCRQSPDPKFFYSLVF-----DVKTWCRIVDPYLEYQ	1491
PIERIS	1332	STLVCVALR---ISVRTAYDDNMRLEFRVFFCANFKCLSAAFLCRQGASS-TFRALR-----DDAVWERLVTQTSISLP	1399
PLUTELLA	1518	CKICKTL--RdgVAPGNDV---WAYRFSQANFNCFAAVL-CKTRSGEKFFQVLF-----HDTVWDKIVDDTKLYK	1582
CAPITELLA	1976	FPLEMENPIERRKKFVSIRTSVR DVDPDDEPTQPASSV[3]ASQYLAGSSLSTDVSQDFGSSMVSSADS[6]SR	2053
TERMITE	1949	LALDWEIIPARRKQVLSIRCAR[4]ETLGFASQSVRYLIPS ASQYLFDSLINEDVTLDFSTSVVSTEAR PG	2021
FLEA	1880	FQOEFENYPTKTKHLVEIR----KAASVDESELNLYLTQ QS--IFSSLSQDITFEDMTHNVVRR--H PV	1940
STONYCORAL	2013	FVELLSAPLERKKQF---RMQAR IPSPKENSELESAG-[9]YSQYLSLSEDSIEDISQCFSSPIQVHS--[12]ES	2096
LIMPET	1968	FKAELDSPLERKKRFVSIIRNEVK ETRQGESEE-SLFSS[3]STQNI EESSLSDDLNQYDFNSGTAQVFFS[6]TS	2044
HUMAN	1990	FVVEVEVPMERKKKYIEIRKEAR EAANGSDSGSYMS--SLSYLADSTLSEEMSQDFSTGVQSYSYS[12]RR	2069
STARFISH	2021	FEIEMNAPMERKKRFVSIIRNQIQ DTVAGSSQSDSGI[10]STQYLANSSLEDIQDFSGGVQVFNAS[17]KR	2116
SCORPION	1961	FPIELDT-IERRRKFISVRHENR ELNSNKTNLNFASLK[2]PSQYLSLSDSDVYQDFSSSELAFSQD[11]SN	2041
SHRIMP	1963	FVDEINFRPASKKRFVAVRQKLR ETAREEGAVAGTVQ[2]ASHYLSLSDSLREDSQDFVFNNSVVLMSQ[3]SS	2036
DANAUS	1365	KPQWGHVRYAPSVSPVSVSS --VPSVPSRLPSKLS LRSVPVFLRSLSENPFMYDLVEEKE--EVS --	1428
BOMBYX	1486	LPIPK-KWSRRRCVRRQVPADTGA --APAAASGGG VTRTRPLRLTLSDNPLHFDLLEPHECEEVT --	1546
AMEYLOIS	1502	LPIVVK--SRRKIKCVSIPIPGSA --ATSSTRSGS--- TRSRMFLRSLSEDPHKFDLYDREE-EQVE --	1561
ARCTIA	1482	LWPRRA--YWGDTKSRQPGGADQ --GPSSVSTLTYSRT VRTSLFMATLSENPMQYDMLPNEDEEDN --	1545
PAPILIO	1492	LPLVE-SWQKRTMHQYAGVKLEE --SSGLLTSASS--- STARTVLRSLSENPFGEFDEGLIQDDQEQC --	1552
PIERIS	1400	IVTQS-----YVSPRPMEMAS VQSRVFLSTLTDPLLYDLHEGLVQTETS --	1444
PLUTELLA	1583	LYIQLELRHQSTKRHTLPAGASE --TELSLSQFTA--- PVATFTRTLSDNPRAYMLEETRP--TEP --	1642
CAPITELLA	2054	ESSIEVPDVLKHEHYIEMEDALNQHECMALSLALQHMKNLQITP[1]VEKGSKPS--SMPDWMKNIHDKIKNSDTQL	2128
TERMITE	2022	HDEKTPKESGAESTEVILESDDLNMHECMATLFCGVI EHMWDQGISP[1]PDAETKDA--ALPPWMSMRKCLSDYSQPR	2096
FLEA	1941	DHKTKEVNFNG---TQIYLTEDFLNDHECMSICGVIGHMVTKGISP[13]TKQGSVVP--VMPSSWMEALVQLANAETPV	2024
STONYCORAL	2097	SSTAEOQDDWYEVSEDTLEMDLNRHESMAKMSLLKHLVDKIKISP[1]QVKDVPPT--DMPANMAPLHKIASSSTHL	2171
LIMPET	2045	SNVQPDQFNNTVDYIELELDELNQHECMATMVALIKHLH-TVITP VLKGTLPK--EMPTWMSYFSEKMTNPTAFS	2117
HUMAN	2070	EQRDPT----VHDDVLELEMDLNRHESMAPLTAVLKHMRSLGPP[1]GEEDSVPR--DLPSSWMKFLHGKGNPVLV	2140
STARFISH	2117	YSNEETPTVVYQGEYIEMESDALNQHECMASLTAVALKHMQANKITP[1]IPEGSKAS--EMPGNMSLQKLLTSQSTHV	2191
SCORPION	2042	PSNEAKDDDLVSNITVELEIDDLNQHECMSLTMVLQHEMKIQI--- --LSSSPK--EIPKWLNDLCKKLEDYSVHR	2111
SHRIMP	2037	ERVITGANEMGGVLPVHMDSQSYNGHEVMANLTAVINHMVDAEIMV[1]HKGDTVPKATDVPQWMTLVQOKLDSADTPR	2113
DANAUS	1429	-----TEFY---LPDNLNRQCPCLPYVMGLLSTYF---AL ---TVET---GWAGAVKEAL---RGR	1475
BOMBYX	1547	-----TEE---WRVDHTELNGLEACLVSRLALAAPCAAL ---RRAA---AALCDTAAALCGAAAGS	1601
AMEYLOIS	1562	-----IQE---IEMPSSPINAHPCAPTVALIT---HVRT ---RMCF---ARVCELLA---RTLTD	1607
ARCTIA	1546	-----DVEEEKPVGYENHPLNAHGCLVSTITALLE---HSST ---LEHT---DNLTKLEGL-TSNLPV	1598
PAPILIO	1553	-----ELC---IPENVINQHPCAGLITMSLS---RATS ---LPHT---TWLTTTLTTL-TNTYK	1599
PIERIS	1445	-----DAEMTE---QVGAITWAHECANVLSLRLHRSV---RA ---LPPD---LYLTPVRAAL-VTSRTR	1494
PLUTELLA	1643	-----QHS---LQVQDNELNHNPCASALTGAIA---YL ---SRQQ---ANLPTVPE---TANR	1685
CAPITELLA	2129	NIRLFLAKVILNGESVFRPYASFQWQPLVALAT---n---MGGLNYFSLDIIVTLLSWHEIAIPEETTVDIAMT--SH	2198
TERMITE	2097	NIRLFLPKIILNVEKFFHPYAHHMNSLKAIT---DGVVGRAPNYLLSDTVAMLADWCRKTTSLPAKSDHHLV--SQ	2169
FLEA	2025	NIRLFLIIDNCQIVFRPYAHHILTPLELLV---DECAGSTINHVFADTVMLMSWHDVAIYPSSTS IQRNIA--SQ	2097
STONYCORAL	2172	NIRLFIARLIIINEAKIFEAHAKFWFNPMLMELILQIkdEPAGTEGINFYIVDLVVTLLSWSTAIPEDSHNDRHLA--SR	2249
LIMPET	2118	NIKLFIARLIFNTSEVFPQYTKFWLRLPCLQIF---sGPLSSDGINYFNVDLIVMMMSWHTTSIPQDTEAERAMS--SR	2191
HUMAN	2141	NIRLFLAKLVINTEEVFRPYAKHWLSPLLQLAA---sENNGGEGIHYMVVEIVATILSWTGLATPTGVPKDEVLA--NR	2214
STARFISH	2192	NIKLFIARLIIINNEVFTPYARFWLGLLQLLI---sGNTGGEGIHYMVVDVVVLGLWVVAIPE---DKRLA--NR	2261
SCORPION	2112	NIKLFLTKLFINNAEIFKPYAVFLQPLINLIL---NATFGREINFYILDMVVLSSSIAPEDSS IGRHAA--SG	2184
SHRIMP	2114	NVKLFLLLVMNNARLIFEPYAAHFVSTILTCLV---DGTIGDKINFFCDVMVMVMGWSKAVPQDVTMGRNIV--GR	2186
DANAUS	1476	DVARVIAQAVCNVRGSLTSHAGSLAPPLLALVTDG-p-----VDQLYTDI FDTIIRWRAEINDKERLEAA-----	1539
BOMBYX	1602	HVAALLAQAVCNASDLDQHNCEILIPALLKVVTAV---EDGAAINGLQVDVLTISGWSGGGARREGADAA-----	1669
AMEYLOIS	1608	TNSCLLAQCICNCHNVLSQANLLRPAALYATST--pkVIGDRQVLLNHLVDILWTVIKWDIKVLPHYNSISL-----	1675
ARCTIA	1599	NAKWTLAQAI CNARTELKPHASVLTALLDVAQT---DGLGDRQVLLNHLVDILWTVIKWDIKVLPHYNSISL-----	1670
PAPILIO	1600	NAKWTLAQAI CNARTELKPHASVLTALLDVAQT---DGLGDRQVLLNHLVDILWTVIKWDIKVLPHYNSISL-----	1668
PIERIS	1495	PLRWLLAQAVCNVPSLI---DTRLRDDLLAVLDT-d-----KGLNAIQLYVLSVVKVPLDVARATGLVTA-----	1556
PLUTELLA	1686	NARWLFTQIINCCKDKLSSADSLTPQLLSMVATT--pyEHEGKLLNGLHVNTLKTITAYAVENMKMKDLTQQEIThLNT	1764
CAPITELLA	2199	LVKYIVQNC---YHQNRQIMRNNLEVLKT-----DIYENFID-REDKG--- -KRNV-VG-LQIVGVFLANGLSP	2257
TERMITE	2170	LLYLLISKV---HHRDRDVPKHNLLEIRTVVLEWPKPFDIPVQLLYDMIMKHDRK DPTVSEPG-IQVAAIILANKLEP	2243
FLEA	1998	FMYFLMKNA---YHERRAIYKLNMEI IKSVEIWKTCCLDFPLQYLY-LALENPVK D-SKTNMG-IELAGILANKIIP	2169
STONYCORAL	2250	LLGFLLMSRT---RHRHRSFLRNNLEIVKSVVEIWKSLIHVPAEVIIF-NSFSDPDP VKKDNVAG-IQLLGVVANGFLFP	2322
LIMPET	2192	LVQFLMANI---YHKNKQIYRNNLEMLKTVLECWHDRIEIPYKIIY-NQLKS--- -BENKSVG-IQLLGVVITCKFPF	2260
HUMAN	2215	LLNFMKHV---FHPKRAVFRHNLEIKTLVLECWDCLSIYRILIF-EKFSKDP NSKDNSVG-IQLLGVMANDLPP	2287
STARFISH	2262	LLFELMHFC---HHSNRQVLRNNLEMIKTVECWKEIISVPTSVIY-RILATPDP DVKDSSTG-LQLLGVVANGFLFP	2334
SCORPION	2185	LLFELMSKC---FHIRKDVFRNNLEMIKTVVCQWKERLDIPTIYIF-ESMRNLDT KVKDNIVG-IQLFGIVVNSGLDP	2257
SHRIMP	2187	VLRYLCMMT---PQTRADIFKYNLDVVRSVVECWKSLTVPVYIYI-SLMEVKDG AEREVEAG-LQLLGVVANGFLFP	2259
DANAUS	1540	-VTSLVTLTtdRHADGRLTDRLIKLDD---IYGSKVTPVWKCLE-KYFADP-- [1]DNKL-PTC---LKIILNRINVIY	1604
BOMBYX	1670	-VRLVTRC1qHQRRRPLDADAVDCLDGLFRAHPGTITVRYDAFP-DYSA--- [4]DET--KLCmLRILQITTKHNIY	1742
AMEYLOIS	1676	-PKS1IDSLisQST---DCKDPLQLLDNFIEVYSQVPIVEWNVF---A--- [4]DRL--PRC-LPVIRRLKRIKIR	1741
ARCTIA	1671	CAKYL1STCieHRSQEGVRSLLNTLNNVLHYGSCMNDWDELQ-KHINEM--- -PKTAPYL-YPILQRLLKNGILI	1742
PAPILIO	1669	ILKKLVEVtiqNRRNKIVTILMQMNLILETF-EPLEIEWSCLY-ECVH--- [2]NBEAKIY-ISILKTLTK-KIYI	1739
PIERIS	1557	---LVRTAveLESRSR--RLMLDTLDSWARAH-AGLVLPDSCYK-EYVADSGR ---KRWSC-MSVMRRVCSSGVRV	1621
PLUTELLA	1765	I1PLYHtcvYHKHRSYVFKALIQTFNEVLLKLYAEGVQWQIDFD-GYLKGMRR[6]DPTNEPAC-LELLTILSKNSVYI	1845

Supplementary Figure 8 Lepidoptera

CAPITELLA	2258	WQPDAEVSKDRFYQYLAMNNQ--PDKQVYSAAEIVGMLSSSQ--NTESD	KEWCRAVGDNIQKMLLGI [5] -DQFL	2332
TERMITE	2244	W---SSTGKLFQRLRLRNIDT-EKRSIFQSSAEVAGMALELLAANGSGML [4]	AEFLSGIVDKLNLTKDQS [1] -DKFL	2317
FLEA	2170	W---PDSKDDDYKALCMQFNS-MESITYKPCSEVIGMVLNLSLGS AENI	--LSSVNRRLDYLRNN [1] -DIFI	2237
STONYCORAL	2323	VTSDSTIDEDRFYGTLVNNTF-KYKDVHAAAEVIGLLMMQLAKVKKIFD	GPLHDMVGQKLLSLVNR [3] LDKFI	2398
LIMPET	2261	YGPDCPVDHRKFFTVAFMLCD-KSKPVYATAGEVVGMLIKYLEVKEQETE	GEFHTYIINNSSLQL-- [3] -DNFI	2333
HUMAN	2288	YDPQCGIQSSEYFQALVNNMSFvRYKEVYAAAEEVLGLILRYVMERKNILE	ESLCELVAQQLKQHQNTM [1] -DKFI	2361
STARFISH	2335	IDKASDIDBERFYAALSYNLKN-RYKMHAAAEVIGMAMKQKADVDKVTD	GFLHSIVTSELTK-ISEI [2] -DVVF	2407
SCORPION	2258	YQNTSRIDKISYKLTLVNLTN-KYKIEYASAEVCGMSKMYFDPKDDVDY	SEFCIKVTEISSLNAK-- -DQYL	2328
SHRIMP	2260	YTVDSLETKKRCESLVIRLLGA-HYASVYGAAAEVIGLILKYTSQKDGVSVE	A-LEDAVVKRVTELTVMK [1] -GQGL	2331
DANAUS	1605	PEVLPAVTR-----LA-----ARRVTLWPVYGRLLRLMKERGLDAR	-HELECRAVLERLRSSD VSDYI	1663
BOMBYX	1743	ERLLPTVLA-----VLADARR--OHPVQK-LAELFGQTLAV-CDDETVAR	-ESLASYQRVLETYLTN VSDYV	1805
AMELOIS	1742	PELIPTLLK-----M--DLRI--WLEDVK--MAECFGAALTECERDGAIQ	-SFRDMLKRV-----KN SESYI	1797
ARCTIA	1743	PELLNKILA-----KF-EVND--WMKSSK-LPEVFGALASL----ETNKE	-EFLPKFWQILANVKSTK VTDYV	1801
PAPILIO	1740	RGLILELVK-----LLESKDT--QTIKQDIAPLFCARLKI---PANDRI	-ENLNTFRKVLNKKYK--NN IKDYV	1800
PIERIS	1622	DGLVGGGLA-----LAVTAA--DMRTLRSIGATLGSALTA----DADE	-VSDERVHKAMVAVRKQG [1] AGAYL	1682
PLUTELLA	1846	EQLAPAILK-----MMESKQI--LAKKLSNTATLLGLALAA--CHDSVTA	-VNLRLKVKLDRMRTGN [3] IQDYV	1912
CAPITELLA	2333	TCVHCIQKHFSAFVER-FIHKVLFLPLGYGVFRTYALEIIAAGIENI---EGAFVEIKNKNIIGILRERDELSQLMSLK		2408
TERMITE	2318	TCLFAVQYQYPRIVDA-FMNHVLFHLPKTYGPIFTMCLKIVYSRLEILG--DDTYAEMKSKNLFSLDRDPQONLALS		2394
FLEA	2238	ICLYGIKHYDPIAYP-YTYVYIFNISRAIDLQKTMILLQLLSVLELKG--EEFYSDIKTLDFDLKDKDT--VILLAK		2312
STONYCORAL	2399	TCVHLKLNYPPIVDR-FVNQILFTLPSVHGDFKRSYCLELCSRVEHI---PNLFTELKGRGLKEMLSQRDDGIQIGVLR		2474
LIMPET	2334	YCIHKIHQQYPTADR--LNLKLLFMLPNLNGESRRLCLEVVHGRIGQI---DNVFMELKTKGLLSFLTQRNEKTQVVALN		2409
HUMAN	2362	VCLNKVTKSFPPLADR-FMNAVFLLPKFGHVKLTCLEVVLCRVEGM---TELYFQLKSKDFVQVMRHRDDERQKVCID		2437
STARFISH	2408	TCIHKLHFHYEPFADH-FTNKLLFMLPSLHGPKLQKCLVLSYISQR--PNIFLEMKSGKIVELLETHRDEGTQVLSL		2483
SCORPION	2329	TCLYKINHFPFIDSSFLNKLILYMLPNVHGIRKQLELINSHVENI---ENAFLEKNGQLLNMLEHRDESIQFSSLN		2405
SHRIMP	2332	TCIYNHKLHYSPFKVR-LINKLLNLLPKLYGIRHNKLECLIAHSATM---EDYHLHKEVDLILAKKEASTQLVALQ		2407
DANAUS	1664	KALFYQLRELDPVCDYKQFCVSDLVPKIPQREPRCLLSILSCYIKHGG---RGDFAVLDTIELEKMDITQ-----GVE		1735
BOMBYX	1806	LLLYYAQIGCPCRCSSFKSFKTVLSKASRLPKAEKLRCLRVIAKYLEHGPgnDDVIRDVVSTLNFEGLLGGDC--VKEALG		1883
AMELOIS	1798	KLLYSQIGKGCEDVFNKQVTDQTRKLPKALQKCLVLSYISQR--tIDYKSMFETIESEFLTTDN--V-EALD		1872
ARCTIA	1802	RVLKYAQRADKCCNQRNRIITDLASKV---ERAGCLSIISVYLENCV-eESSCTEIFEIIGLKELLDGENKIIIEALK		1877
PAPILIO	1801	DIVLFARENADISDELPRSIKLLPKMVEESKTCLELISLTIKEKY--SDDVKSFLSKEVCKLVQEGD---SATLV		1875
PIERIS	1683	TLAASAAVYPALVNANNARIVDTMATKIIGRDKQKCLRILCAFAKNAKhsDEQIADIFDLVEPTVSLTCDP---LTIID		1758
PLUTELLA	1913	KVLFYVQNGYKCCNESNFRHITAPLAPKVMREKAKCFEILSTYLARTSsnTEYVTSMWQADICBSMVGEO--SNLAMK		1990
CAPITELLA	2409	IIRLLEKLEAS---QLLYLPAICEISDLSSVLCRREMYQILMWCYDNYK [1]	EAQSESRDEIITLTKDV LLRGL	2479
TERMITE	2395	IHKMVPHLKPE---QLEELVHEICKFETQRSVKCRSVMYELKWIYDHCQ	---DIGV-LIEBAKI LKGL	2460
FLEA	2313	IHKLLPFLQND-lnRPSTLIQAKRLISSDTCNRSVVDIAMTSYKIIQ	---FKSDYDILQNVQYI LLLGL	2381
STONYCORAL	2475	IHKMLKLTIP---ELKFIPLLTSPVSHNLLCRDLMYDFIWIYDSYR [4]	FQAEESADILADAKH LKQL	2548
LIMPET	2410	IITSYREKLLSK---EMSLMDSITAFSHSPSTLCRKMVELLMIYDNYR [1]	DECTEGH-EIMLKTKEC LKGL	2479
HUMAN	2438	IYKMPKLPKV---ELRELLNPVVEFVSHSPSTACREQMYNLMWIHDNYR [3]	SETDNDSQEIFKAKDV LIQGL	2510
STARFISH	2484	LNVAMLPNLKPD---EILYLLPPVRTVFNLPSPACREVMYILMWIYDNYR [3]	SRTEDGADDILCAKDT LKQL	2556
SCORPION	2406	IQKLLKELDID---KMLNVFPIISKVHKS AETICRKMVYEMMHAYEKFN	TKNGIKEKEISRYAKEM LLHGL	2475
SHRIMP	2408	LNVAMPRLTPS---QLLYFMPGVAFASHPAPSCRETMYDLFVYVDFNS	NNDTEDGHQLESQARGV LLRAV	2477
DANAUS	1736	LASTALHVMPS---LRQVLSAESAAGPA-----AVFPLVMRDFELQR	--SS---EEPSIKRPAR [4]	AHSTL
BOMBYX	1884	VRSLGQRYGN--teVLSAVMLAVKLCDBPAADVRAAGDVAKKAFKELC	-E---DHEQSAPKRQRS [4]	VLVRA
AMELOIS	1873	LVANGLFLMEN--g-FKRRIVQALEYCGHSAERVRKIAFVIAAKAFEELV	-NPLVNTNDCAPAKRP [4]	LTDLA
ARCTIA	1878	VAHNGLKPMDS--e-MKKDILNAVSNCRNSSVSRKQAFVILKIFQDLV	-IV---KTDHSAKRRAL [4]	ILDTL
PAPILIO	1876	LVGRGLTRMGRLtiVGRGLVQSAKHCRSDVKVRDAAFVLSRAVECLF	-TD---DLETPPKRSAR [4]	LLQ--
PIERIS	1759	LCTAAVPTARQT---ARRRVITAEQLATPTT---LASPQLQRAAYLL [10]	EREKKEVEPAAKRRAG [5]	ILSLW
PLUTELLA	1991	LVKSLHLMEE--r-MKRRTVMLAADFCSNIVVVRRLAFVMLRAFEDIQ	--SS--EDQEPAAKRRKG [4]	ILDLL
CAPITELLA	2480	SDDDLNRLTVQNFWSHETRL-PGETVERLV-AMLEAMYTPSTELHY	LSVATNLLLEMTKSSDNRVLFDTPLSE	2553
TERMITE	2461	RDDPHLQDSIFEWYNSDAQDASTSDRL-LFLTDLVCPATEHIF	LGSTQYLLMAGTTPYDQKIFKPELQK	2535
FLEA	2382	LDSDAQMNDKMQTFQWSENAL--PKTYDAIFKYLMSNLVDEHLEKNF	IQGQVITLILALQNSDIQRNIFEHPLSE	2455
STONYCORAL	2549	ADDDHDLQLKLNFWSDEARL-PGTTLERLV-EVLRALYSTTTEIQY	LSMTNLLILHLTSLSPDYERLMPEOPLSE	2622
LIMPET	2480	GDEDMCRLLVQNFWSSDTRL-PTGTLDRMV-AMLEAMYSPTSEQY	LSVATNLLLEMTKSSDYQREIFEHPLSE	2553
HUMAN	2511	IDENPGLQLIRNFWSHETRL-PSNTLDRLL-A-LNSLYSPKIEVHF	LSVATNLLLEMTKSSDYQREIFEHPLSE	2583
STARFISH	2557	SDEEASHRLRVSNFWSHETRL-PTGTLERLV-AMLECMYSPGTEHQY	LSVATNLLLEMTKSSDYQREIFEHPLSE	2630
SCORPION	2476	ADSDLTLLRLTVHNFWSQNNHL-PAETFSRIK-AVLQKMSPEIEHMF [39]	LSVATNLLLEMTKSSDYQREIFEHPLSE	2588
SHRIMP	2478	KEEDAALRQIVLNFVWLGQARS-MTLT-QCLL-HILRKMYSPESEDSF	LQMAIVVLEAATRESDYQRNIFDQPLSE	2550
DANAUS	1799	QG-----LARGLAAG-----LRGL--RGLSS-DLALRL	-----LARGLAAG-----LRGL--RGLSS-DLALRL	1825
BOMBYX	1955	QGADRYTGSLLRGLGQGLTGD-----IQGL---STT-SFHARF	-----IQGL---STT-SFHARF	1990
AMELOIS	1946	HENDAYALTVCARAAGVTSR-HSDVTAAGVGA---LAG-GAGERL	-----LAG-GAGERL	AD 1988
ARCTIA	1948	-GSTGFHEIIVKEVSGVFDG-NEEIANMRDGVETCLSK-DMAVRF	-----NEEIANMRDGVETCLSK-DMAVRF	AE 1993
PAPILIO	1947	---DEELKVALATLGMKLVSD-----DGLRDVAQSSCLPT-EVTTFR	-----DGLRDVAQSSCLPT-EVTTFR	CE 1985
PIERIS	1839	---EDMAWRGVLRRTVVLDHT-DSNIVKGMALQVSLVSHVDHYTRL	-----DSNIVKGMALQVSLVSHVDHYTRL	SE 1884
PLUTELLA	2062	QVEDVYTLTVVAKLGGQLVDE-VVDISSMVGQGVVHLS--DMSVRI	-----VVDISSMVGQGVVHLS--DMSVRI	CE 2108
CAPITELLA	2554	CKFQDFAVSSWYQRHAM-TPMFLDTQSSC S--SQSNDSPDAGLST [2]	LRATQDAAQFTQCA-DG [2] KGPYNWLTSS	2626
TERMITE	2536	CQFEDFRMLLWRANATV-APMFADTLASQ [2] QGCLSGTGEHTGAGP [1]	LRATQASLAFQPTIEQSG [2] IGLSLSFSLSS	2615
FLEA	2456	CTFKSYSDMNDWHIKNSAT-VPLFAESFIPK [2] SRSTAT-----	-RSFOVYIGSQTIAAYFK [2] IAKIPMIQATC	2523
STONYCORAL	2623	CRFEEYQIDYSWQKRHLAM-TPLFAATGSSH [1] SGMTPGCSMSVDGSP [1]	LRATQNL-OFTFQD-- [3] STAFDNLNFTG	2698
LIMPET	2554	CRFQEFVSKSWKQRHAM-TPLFAATI-----STVSEMEGVEDSLDG [1]	VRATQDV-OFTFQD-- [2] NAFPNWLTGSS	2625
HUMAN	2584	CFEQYITDSDWRFRSTVL-TPMFVETGASQ [1] TLQTRTEGSLARWP [4]	IRATQQHDFTLTQADG RSSFDWLTGSS	2663
STARFISH	2631	CRFQDVTIDHSWKRHLAT-TPMFVETGASQ [1] SSGSQCSPDSSLSR [2]	IRATQDAHOFIATQQLDA [4] KNAYNWLTCG	2713
SCORPION	2589	CAFQNYISSSWKRHATL-TPWFVDSLSA [1] SPSDTSVKNIDE--- [1]	IRSTVDVREFDPTD--- [3] KKAFNWLTGSC	2661
SHRIMP	2551	CKFEREMKYSTANRRAHAM-IPMFAETGASN [5] SLLSYTQSGSDTNMETD [4]	VQATG-ANVFSATQCPGA ---TYNVTDST	2631
DANAUS	1826	CLLLSLVPL-----AD-----GLRVSLAA [1]	---VELFLQDIREQDT -----F	1860
BOMBYX	1991	FYLAIK--LPIHLSKTPP-----DVTSAVWN [1]	---TRMLFAAAKGQDG -----L	2030
AMELOIS	1989	CLALMLVKGATEIHACAP----- [1]	---LELFFADLRSEK -----F	2021
ARCTIA	1994	LFYLIIFY---MARKDRK-----ELSHCGYI [1]	---LDLFLRDLKRDQD -----Y	2030
PAPILIO	1986	SPIISVYLPVVYGDCKSTN-----CLTALLY-	---MFKDIRDTEA -----L	2023
PIERIS	1885	IVLLCCT-----LESCGF-----	---DV -----L	1900
PLUTELLA	2109	CMILIALNQPVSVKPSVVAR-----ALTAAV--	---RMNVQVLRDMEA -----F	2146

Supplementary Figure 8 Lepidoptera

CAPITELLA	2999	HQEVYLPMLRSKIKLILNDtSQDNLLSFIEES---	LKTPVHKAFIEGSPFSEELALVCIHQELYDKAKHYANMSLQAFI	3075
TERMITE	2959	LQEKLLPQILLSEIQMMLDKG-VDSKREQFLQQVdwrLRRDRKSDYLSHSHYCEELA	AIFLIQDKLDQAQHQVEHSLTMFL	3037
FLEA	2872	AQEKLFPLITSEIHKAINSS-ENSEFSEFLSS---	wLSDSEKAAYLKTNFSEELSIFNIINGDIFGGGYLQEKLLMFL	2947
STONYCORAL	3081	YQEHYLPHLITSKLLKQCGS-GDMTLENFVAKA---	MKTSERAALLRSYSDSLAMVYLQDNCDSASYAALSEQSFL	3156
LIMPET	3004	YQEHYLPYIIRSKLKLLELGG-DQQSLLTFVDTs---	MKTTYRAVLESRYSMELSLMYLWQDNYDRARHYANLALQKFL	3079
HUMAN	3036	YQETYPYMRISKLLKLLQGE-ADQSLTTFIDKA---	MHGELQKAILEHYSQELSLLYLLODDVDRAKYIYQNGIQSFM	3111
STARFISH	3095	YQELFLPHMMRSMKQLMEGG-EDETLLOPFDAS---	MSDADRFLFLEARYSEELSTLYTIQEDYDRAMFYLANCRQSF	3170
SCORPION	3029	YQENYLPFLIKSKLKLLEIENR-NDQSLTTFIDSA---	LKEENKKYLEENFSEELLLYI QENYDRAQYYSQCLQDFL	3104
SHRIMP	3014	PTATALPALVHSHKLMNILDGSeTDGNLIAFDQS---	MGDRHRSMLEGDLPQLQGLAAHQEKFPEQANVYANTATSMFL	3090
DANAUS	2063	TFRLCVDKY-----DFTDAFF-----	WTRCL-----MGDRHRSMLEGDLPQLQGLAAHQEKFPEQANVYANTATSMFL	2101
BOMBYX	2262	DLQRLQEQY---EIDS---DT-----	WFDKM-----VSKYREODI-----HTYQVILKEL	2300
AMEYOLOIS	2245	TFKIALNNSY---K-DSHIGES-----	WFDKM-----VLSY-H-EE-----TRNSARWLSDV	2284
ARCTIA	2252	QFKTYLGEYFEAKQKNIDYKL-----	WFNKM-----AGSYVSSKLGKTILOFKQKWLKRM	2301
PAPILIO	2231	NFRKQIDDW---KVTS---SNT-----	WFDKI-----LLYQKSKN---TYKYVQWQNDV	2271
PIERIS	2062	SFRREKESY-----TGEVVG-----	WLHSM-----WSGLDADRDESG---LYRILLAA	2100
PLUTELLA	2384	TFAAANFSS---E---ELPS-----	WLNIM-----RLSLDHNNF---VEKQFEWTKQL	2422
CAPITELLA	3076	QDWANLSTTRTSTRATKLOKLOEFTMGEQFLFSVIKTTSGEDFP--	RQIDRTLHKWEARSPDRLLDSVVIWQNDIILNRNRY	3153
TERMITE	3038	DSWAALNPSSNHLRTKQLDLOKTAELKACAFATNGEHSKQE--	LLAKELVKKRWKKNVPSA-FDSLLRWDIRAMYKKF	3114
FLEA	2948	KDWSNLNPLSNELRLKMLMDIQKTESIQMFRMTTKKSDKIEYA--	ATVRKLIKKLWNMMAKP-SDSLLIWESEKLYRMLF	3024
STONYCORAL	3157	SDWAGLDSNLRSSRIKLOSLQKITEMQEFLEFIABEGNFSP--	MPVLSLLNKWYRSLRPHLPHIGVWDDIVTRNVL	3234
LIMPET	3080	QWASSDTPFLIVASRTSLOLQTLQPLVLEHFEFLTYISNENDITH--	TA-NQLLKSQWRKQPHKLLDPVNIWDDVISOQRY	3156
HUMAN	3112	QNYSSIDVLLHQSRKFLKQSVQALTEIQEFTSFLSKQGNLSQ--	VPLKRLNLTWNRYPDAMDPMNIDDIITNRCFL	3189
STARFISH	3171	HDWSGLPLMISRRRAKLQCIQRLETKQNFQLKLAIPDLQEAIGCQKSE	LLDRWSGKDLDSKDPINIWDDVVSRLLY	3250
SCORPION	3105	KWSSLNVLMPIIRKFKLQSLQKHIELOEQFLNNIDTYRINIDEY--	HFKNLTDRWLKRYPD-I FDSVNIWDDIIMNRSLY	3180
SHRIMP	3091	LTLQSYSVLTNPLLDQLNQVLLTSLSDCLNFKVAADRDFYS--	SKVKQVTVTSWKQKCRIDDNPL-MTQCLASYRDLY	3167
DANAUS	2102	VRWPKRQF-----DVAAVLSGSQQEVTVQDDM-----	NDCLSKWAFRAMGSLC	2145
BOMBYX	2301	ARWPKRQF-----VLSCMAEATEWKCSEDNIDGLYSCV-----	R-IGSGDCLAEWAGRMLRRC---	2351
AMEYOLOIS	2285	AKWPKRQF-----QESAVAALSSQLEEEP-----	WVC-----R-MSKRDCLEWESARLMLRA---	2331
ARCTIA	2302	ERWPKRQF-----VVASVIEGKIPADDTL-----	MTC-----DIKASDCLAEWAARMLRSAY	2350
PAPILIO	2272	CRWPKRQF-----AISATIDSFELKRMQDEHAQELE-----	CHIQSEDCLEWEAARIMTRSAC	2325
PIERIS	2101	DRWPKRQF-----TFSAEI-----WKGDFEVQECNWLE-----	H--RDRVCLAQTAALMMRSLR	2148
PLUTELLA	2423	DIWPKRQF-----DNSAITEATEWHSIVTTEGDNINKLP-----	RDIRPSDCLAKWAVRMLTRSLY	2476
CAPITELLA	3154	MDHFAEHL[3]-DAKI-----DPFGKQRVMSLQAQVDAAALQGNH--	S VARKLLKSAKDLVKVVDSEELSVLFTSHSA	3223
TERMITE	3115	TRNIQDML[1]-----NTGASNALSRSTELANGVDSALYQENF--	Y LARKYLRREAREKMSNS-GTDMELQCSLAYS	3178
FLEA	3025	SNHIKQKL[9]-----INEELDNCKIKMELSFLDAAIKQKNL--	GLSRIYIRKCLKDLGKHE-DPEKNYRWIRSRC	3097
STONYCORAL	3235	MSKFLQK[6]ERSGICLDDIKDFPFQKQVELKLCMANAAEQGNY--	AVAHRCLKEALYKIPQG-NENLNISWSHTYA	3313
LIMPET	3157	LQHSIQCL[3]-NKESEQMEDEGMFHQSLLKRLYLAIAESCEQNNI--	ALTRLRILKKTNSASVSDNEELKVWESQLYA	3232
HUMAN	3190	LSKIBEEFL[20]MEVQEQEEDISSLRSCSKMKNIDSARKQNNF--	SLAMKLLK-ELHKESKT-RDDWLVSQWQSYC	3281
STARFISH	3251	MDKLGSR[5]QQAGEEBETALEKIRLRLRLELWLEKMKADSAQQGNF--	SVAQKHLK-ATHGSLSA-HEDLKPWTSYV	3327
SCORPION	3181	MEKIVSKL[21]DSEPNYSYFSEKFLKEQRLLKMKL FVEAALLQGNL--	Q VAVKHLKWSQQIAKELKADHWHWINCIHYC	3275
SHRIMP	3168	LHLMEKLL-----PEDSLDVSNIKDITKNTFRTRVIRAAALHNSNY--	HLANRHLK---KISSLSEDEYSKAQFYFMM	3234
DANAUS	2146	-----SN SSKGSPSS-----QSGIATPND--	DKISLDMRHQEL	2195
BOMBYX	2352	-----AQGV AGGA-----GAABELRWAGGAARA-----	ALWGHVSACVERARGQLINDADVPKFLLLNL	2404
AMEYOLOIS	2332	-----AQAN EREAMYPS-----SANELLWCVANEM-----	GLYRVLQCCDRNNIADLYDEKISWHHQKL	2388
ARCTIA	2351	F-----DGD ERKSM-----CRGDELKWCSEANER-----	QLPKLALQCIERNKG-SLFPVNEALPWFYENV	2405
PAPILIO	2326	IQKMYEDM EESCPISPSH-----SHALRWKARANEM-----	ALPLQVLSMCRMTIDECEL---STLPWRCEEL	2384
PIERIS	2149	L-----QSS EHSSTQAASA---LHENMMRWCSL VNNIIRGAPENLrtALFGVD	IRVCSQLEL-----ETIDNGLIEEL	2211
PLUTELLA	2477	LSQLADSN DSEPVLQAYRARCRRSHELRWCEAAD-----	LSASVLSCLKRNAG-DLNESETLWLYQHI	2540
CAPITELLA	3224	N-ANKRKCASGSEPSERLNLVVKRRLDKCESSTLKLNAALLCDQHLLQGEHLVMA-T	ILQNQVKDIDALDQKL	3298
TERMITE	3179	K-AKWLQALKNITTEDEKLLKGLDSVSVTEQDQ---FEQYPLMAHETLQHVSVMAAGILQQ	LEQQPGVTLKLPAAE-	3249
FLEA	3098	Q-QIFLQGLEITDIDKKVQDCHRSWMDLIESLKEIDNLKYYPNYLIDVHVS	IVDVTKLFKHL	3173
STONYCORAL	3314	E-VHRKQITLTVAGAVETALVAGQ-LDKFSAKMLIEIPELRGIQHHLRSKTFDILCA	MLDGGVVIAT-LESQA	3387
LIMPET	3233	S-THKKIISNDWSEGDINGLLT---IGKFNDSKVLKSKPDLRHRHVLTA	TATSYELLAES	3303
HUMAN	3282	R-LSHCRSRSQGCSEQVTLVTKTVSL-LDENNVSSYLSKNILAFRDNILG	TYRIIANA	3356
STARFISH	3328	Q-MNQKILITIELKQVMTLLTFDP-LAKLSNTPALTDGICLRRHHTLSKSY	DLVAIA	3402
SCORPION	3276	K-IDLKKAKNQYEPQLDTLCAHQ-LAKLDLHFFPKLDVBS-TMNHYLQSEI	EIEMAADI	3341
SHRIMP	3235	A-ETHILRGQCKQDRLKYLVEAWAKYLGVRSSMSILDQNPVREIQYLK	LESHELCLEICRA	3310
DANAUS	2196	L-ALRGMALQSNDRQALENILELERTESMIQSGSEHSGY-----	-----DMLRVYE	2238
BOMBYX	2405	K-MKREMAT---GASGKLEDELTKAERHAPVVL-----	---EHASDEEFGYINE	2446
AMEYOLOIS	2389	L-SLKGMALERNDSLLREALDASVSLTSDLQ-----	---EITPDA---IGYK	2430
ARCTIA	2406	R-ARRLVALRENDTSKLQKALQATEREDKQVS-----	---FGLKH	2441
PAPILIO	2385	L-ARRQLALNRNTEELIQIRDMAVCYSNDLLVENKTTTEAMVIELKPGT	SQENIDCNIKL[6]LLNNTPVKSILGLNY	2466
PIERIS	2212	VAKRGLAIIHRNSPTLEAETLEFAQEKSRGLSERSKEP-----	-----LRLMQ	2254
PLUTELLA	2541	A-ALRTAGLSKNCADTLTKALAKAQGLSEFA-----	---DKTTPDVIVAMNR	2584
CAPITELLA	3299	L-EKITESVSPALSHQE[2]ASLHEAAYNSFKSGV-----	VAASQPESVC-----VNKAYMSLVHFCQVLRQRENDE	3366
TERMITE	3250	-VKKLADRIGAPDCSQDPT[2]QNLKQYGLSSLKTAEEV-----	TPRGNSE-----QAVAKAYLVQYKACRAHSNTSREDN	3318
FLEA	3174	FILKHGQRGELSHS---KTLDFIFGKCLKQSKIKYAE--AAHANNDINI	EISTVTCNCKYKMIQF-NMHNLYAEED	3242
STONYCORAL	3388	K-NALVKLCRIDETESQK[3]SDLMTRSFSVLSQSAIKAAK--NAEGK	CNTT---QTSCTVDAAMIAMVNFCDNLRKKEVSV	3462
LIMPET	3304	C-DKLNKLLKTDNLDKTQ[4]SDLLQKSHQELKSAISDSV--VTRS	RSSESFT---EADAQIALSKFCDKFLRMKENE	3376
HUMAN	3357	R--RILELSGSSEDESEK[2]AGLYQRAFQHLSEAVQAAE--EAAQ	PPSWSCgPAAGVIDAYMTLADFCDQLRKEENA	3431
STARFISH	3403	KLDKLLGLVGNATRPEQ[2]STLYSKAYSLETLQAVSLAD--KDD	AVTSQS--ERSMT--EAYMALVSFCDRMLRLEKSE	3476
SCORPION	3342	-EKIQELTDFTSIQSKS[3]IDLFCNKYEVKRAIDIIQ--EVEQ	KMIEFD---QATIGETYFKFANYCNKILRMQE	3415
SHRIMP	3311	VLSKFKFENANGKESWQRE---LLSCSYKSLQLVANCAEgkLVK	SDALNQDdSKKSDSdHALALVYKCEECVIKWKDHW	3385
DANAUS	2239	LTLRLRDLNSVVERVNV-----AIVKVMGVDRn-----	VENDV-TRNLDTLCLLGTICLETMFMENSTDI	2300
BOMBYX	2447	MLLRIRSDLGTMMQASMD-----AVLTQVDRRLQ---RGG	AVSPDS--RRALDSMTEMFYVYNHlwTES--DDE	2510
AMEYOLOIS	2431	QIFLLQQHLELTAASVNL-----GLEKVTNRPD---QDS	SILN--S-KSTLTLYELALVHYDRQWSD--D	2491
ARCTIA	2442	LTLQLRDLGLVNSKSLD-----EMLLSNLNIETED--HSS	FYSNKN-GVDLITLYEFAMHDHYDELWELS--DTST	2506
PAPILIO	2467	IINIQKDLNDLSAEKIK-----FLLNDSRDLRkt---SE	SSVVGEN-KKVLHNMVIMAVTHYDENWPM	2531
PIERIS	2255	LILKLADTNVGNRALVE-----EAMTKRQTLTa-----	KD-ESETRPILATVAQHLFCLFERTDVED	2313
PLUTELLA	2585	MTLNLLNDLESLTQKTE-----AIIQDIDRQdSI	LKDSGHSNK-MKNMESAYEIALHYNDNWEHCID	2652

Supplementary Figure 8 Lepidoptera

CAPITELLA	3759	KNSCTLKDF--LRQGCSDVSWEQIQN-kNLPNNPANLLCQWIGDS[11]KCYQKYSrNETLNAFKKREAMV PWDL LRKSY	3842
TERMITE	3727	GAHMKYSP-----EETSA-----EFRK-----	3758
FLEA	3587	PXTKTLRDMmFLKEPGIKNRVEEVRS-----SYNKWIRQASKT[10]NAVVHYHrDAVISKYQELVNR IPEDI LKDSF	3665
STONYCORAL	3851	NNTKPLKGV--LNSAMTKAENDHYIG-pNGAGACYRNWIDKF-KG[10]EMFKKANrTETERSFTQKQALV PWDL LRRAF	3932
LIMPET	3762	NNTPLKDF--VYGALTEQERKYILG-qGGPGKQHENWYKYFDA[10]KVYQNYsrAETIKDFRMKENKV PWDL FRRAF	3844
HUMAN	3807	ENTVTLKDL--LLNTMSQEKAAYLSdpRAPPCEYKDWLTKM--[10]LMYKGANrTETVTSFRKRESKV PADL LKRAF	3887
STARFISH	3872	QNTTLKEF--LHLAMTEQEGNAYNS--HGPRYQHSSEWVKYAG[10]JAVYRHANyTDTVKCFRSWEAL PWDL MRRAF	3954
SCORPION	3793	DNTNVLGSF--LKDAMTDEKESFRE--SDPKMTFYKFLSKTNS[10]NIYKIAD--TEVNKKFTecINMI PWDL FRRAF	3873
SHRIMP	3764	DSTQPLKDF--INDSYRENETKCYGE-----ARALYGNENY	3829
DANAUS	2589	ENNTRLRDM-----V-----DTGGDA--GVTRTADENLLLNVPQA	2642
BOMBYX	2806	EGHHSIRSL-----AAKSCDLNGLV--S--RPLDADLAEPPSR	2862
AMYELOIS	2767	EDHETLFLSL-----INSVCDLDEISM--SVPRPADDELIVSPTPH	2822
ARCTIA	2804	ENYQLQEF-----MG-----DKVRI--PVVRLDNDKLVLSPLA	2856
PAPILIO	2831	EDHVRVRL-----IANKYDIKIGIES--TL-----GEKLIQDTRH	2885
PIERIS	2587	EDHERLDAL-----ASN-----TL-----SALALREAM	2608
PLUTELLA	2964	EDHVTVRSM-----VSKYKLNLEITA--SVRRPPDELILASAAA	3022
CAPITELLA	3843	QKLASSPESYFVLRGNCATSHALNCISAYIMCIGDRHLSNHMVDLI	3915
TERMITE	3759	QRLSVSPESYFILRQSFACSYAVLCIAHMLLIGIDRRHLSNVLVSK	3831
FLEA	3666	KMSANAEAFPTLRHNFATSYGTMCIAHMLLIGIDRRHLSNCLININ	3738
STONYCORAL	3933	LQLAVSPEAFFILRSHFASSHACLICQVILGIDRRHLSNVLVDM	4005
LIMPET	3845	HQMSTSPFAFVLRCELVTHATISICQVILGIDRRHLSNFMNLK	3917
HUMAN	3888	VRMSTSPFAFVLRSHFASSHALICISHWMLLIGIDRRHLSNFMVAME	3960
STARFISH	3955	IQLSASPEFLLMKRRNFARSHAVICQVILGIDRRHLSNFLISLK	4027
SCORPION	3874	LKFSSTLEAFVILRYNFITSHAVLCISQVILGIDRRHLSNVLVST	3946
SHRIMP	3830	VRMSSSTEGFFSLRSFAFVSYAALCISQVILGIDRRHLSNVLVSK	3902
DANAUS	2643	ESGCTLEEFIRKKTAFTESLGHMTAFSICGLSDRHLONILYDPV	2707
BOMBYX	2863	QELCCTSEDFIRRRKRFQDSLATITIFNVIIDVDRHLENFLVEAS	2931
AMYELOIS	2823	ERNSSCFEDFLMKRRNFQDSLATMAISDMLLIGIDRRHLSNVLWSAR	2888
ARCTIA	2857	ENKCSSELEEFIAKRRMFLDLSMTMTITNVLGVDGDRHLONIMINKQ	2924
PAPILIO	2886	ELNSSLPEFIMKQNYVESLAAMTYATSLGLLDRHLSNVLVSVQ[14]CGCVLAVDWN	2967
PIERIS	2609	RKRSAQAHFLEQQRRFTEVAASVTLTALLGVGDRHONLLVSVQ	2677
PLUTELLA	3023	EDDSCSLQDFLQKRRNFAETLGSNAIHAMLLIGIDRRHLSNMYDRA	3099
CAPITELLA	3916	FRMTRQLRNLLPLREKGVIEGTMVHSLRALRQHKHQLISTMDVFIKEPSLDWQNAAKKEIQAMSNR-----[12]WFP	3997
TERMITE	3832	FRLTPHIVSLLQLPEETGLFRETMIHCLTRLNMYDMLLATMEVFVQEPSIDWLE-----FASRHESLNKK[7]WYP	3907
FLEA	3739	IRLTPHIMNLMPEPTAAFGILPRVMVHALTRLDARSVLYATMNIHFHEPLINWLEPIKMYGVRSEDEALNYT[11]TMA	3825
STONYCORAL	4006	FRLTQQFVNLMLPLKKSGLTQSVMHHTLRALRSNDHLLNTMDVFIQEPSLDWQVYARKQAKTQG-----INE-[6]WYP	4082
LIMPET	3918	FRLTQIINLTLPLGLKGLLENTMHTTRALRQDYDLLNTMDVFIQEPSVDWLNFAEKQRNEMLMT-----[7]WYP	3994
HUMAN	3961	FRLTQFVNLMLPKMTGLMYSIMVHALRFRSDPGLLNTMDVFIQEPSFDWKNFEQKMLKGGGSW---IQ-[8]WYP	4040
STARFISH	4028	FRLTQIIVNLMLPFKKEGILQSSMVHTLRALRQNHLLNTMDVFIKEPSLDWKTNASQAKQKADAGRVL--[13]WYP	4115
SCORPION	3947	FRLTQYVNLMLPLKEKGVIEATMISALSALRDNADILLNTMDIFIKEPTVNWQENALQKRIIGKVDENVD[22]WYP	4044
SHRIMP	3903	FRLSPIVNVFQPIGQVGLMKEIMVSAALGALQESRHLVTAVLEAFVKEPTKDWLDFVQKQEGDTQDSK--VEL	3975
DANAUS	2708	ARLTRNLLAVC---RDTVLEARLQRLSRRLREYQGIILPARNISLK-----RSGH-----L	2755
BOMBYX	2932	ARLTRNMLAMC---DPIALEARLQRTALQRLRSRETFYLFATARLLYA-----RAPACQ	2980
AMYELOIS	2889	ARLTPCLLALG---DAQVLESRLQRLSELRECOYLFQCNFVMSFL-----W---DKQNI	2938
ARCTIA	2925	ARLTANLLAVC---DVKVLESRLQRLMLCLRQSRRLYFAFVRSFY-----W---KGRDF	2973
PAPILIO	2968	ARLTRCLLAPC---NLQVLENRLQKLTSETRSHRLLSTLQLSYK-----WM---GNEIQ	3017
PIERIS	2678	ARLTRNMIAFA---NPLESLIMEWSEVIREYAPPELLAILRVVYR-----LDP-----SQL	2726
PLUTELLA	3100	ARLTVLVAL---AGLESRLQSVLASLRDLSHLLPSIKVLFK-----WMPEYESNEFQ	3151
CAPITELLA	3998	KEKVNIVRQKLEGNPSHVMRAELALGQ--LGS--YLFYFVIVLMGDKQAD-IRARLPADGLSSEEQVAALLNLA TD DPNI	4072
TERMITE	3908	QOKLDAKRLKLEGANPVITTELEKAGFKDsk---YLAKFLEC---VKGHNsVRSQMPSYQLPEEQVDSLLDQ AD DPNI	3981
FLEA	3826	HKLRLMARLKLQGSNPVHILQDELKHSFvSTIneiVVNHYIEKGMGVBQHN-IRRRIKMKDLTAKEQVDC LD ADDPNI	3904
STONYCORAL	4083	KQKVQSAWRKLEGNFPAVYMRDLDLQGH--SKQS-WYKQMESVCLGDRNAN-VRAREPESGLSVESQV SL LDADDPNI	4158
LIMPET	3995	KQKLYALRKFKGDNPCHITKDELVLGH--SRSP-AIKHFECVGLGDAKDN-VRATLPTGT LT VEQV AL LDADDPNI	4070
HUMAN	4041	RQKICYAKRKLAGANPAVITCDELLLGH--EKAP-AFRDYVAVARGSKDHN-IRAQEPESGL SE ET QV CLMD Q ADDPNI	4116
STARFISH	4116	REKVNFAKRLKLEGANPSDITQRELALGH--SRNP-AFSAIKEVVKGDQRSN-IRASSPKSGL SV ET QV CE LD ADDPNI	4191
SCORPION	4045	KQRIELFAKRLKLEGNPCYITKEELRLGH--SNKP-IFQRLTDVCLGDRK-S-LRQNLPKNGL SV KQ QV KS LD Q AD DPNI	4119
SHRIMP	3976	SKRIELNLDKLSINPAYITLWAVSQNFVAKQK-AYENLKQAVLLGDRGES-VRASVGERGL SH Q QV DI LL Q AD DPNI	4053
DANAUS	2756	-DKLPAIRGKIQRLLQHQVTKIEWIQRS-EVKYK---EKYLELLDIF-G---TDDKCS TV EE QV SN LL Q SD DPRI	2824
BOMBYX	2981	-PQLSHVKAILGKVTADIRVEANPDP-DLDRL---RALLV---QVFPG---RPATDT SV KD QV QV LL R H C TD PRV	3047
AMYELOIS	2939	-ERLPHIQALLSGRCLSRDVT R ALLENs-RVYTK---HAYLTLIDVFKD---FERKEQ TV VE QV IS CF LV H C TD PRV	3008
ARCTIA	2974	-SEIKHVRNLLQGSMTSYQVTRDVIENS-KIKHK---QEYLNILDVAVFN---FTCKQT SV EE QV SC LL Q H C TD PKI	3043
PAPILIO	3018	-EKLENVYLLQCKKLSHQVSVRNQKSF-----GDYELLNHFIDK---FASEKV TV KQ QV T N LL H C TD PKI	3082
PIERIS	2727	-YKLEMMQQLVRCQVSHQLSLQQLQHQ--QKRY---ASLELVLDLFDQ---FPDKET SV Q QV SS LL LS TD PRV	2795
PLUTELLA	3152	-KKMQYIENILKGRKLSYQVTEVLDKTIKMKHA---DKYIALL TE IF D ---VPLKET AV EE QV TC LL R H C TD PRV	3222
CAPITELLA	4073	LGRIFAG EP V V	4084
TERMITE	3982	LKGTWQG EP W M	3993
FLEA	3905	LGCTWHG DP N M	3916
STONYCORAL	4159	LGRWQ EP N V	4170
LIMPET	4071	LGRVWQ EA V V	4082
HUMAN	4117	LGRWEG EP W M	4128
STARFISH	4192	LGRVYAG EA W M	4203
SCORPION	4120	LSRIYFG DP W F	4131
SHRIMP	4054	LGRSNIG DP F L	4065
DANAUS	2825	LSVTRSG EP W I	2836
BOMBYX	3048	LGATRAG EP W L	3059
AMYELOIS	3009	LQVTRAG MP W V	3020
ARCTIA	3044	LSITPQG EA N I	3055
PAPILIO	3083	LAITRSA EP N I	3094
PIERIS	2796	LAFTRPT QP N M	2807
PLUTELLA	3223	LSVTRTG EP W L	3234