

		*	20	*	40	*	60	*
Rh-EcR1	:	-----						MLSELQLQLGRRSA
Rh-EcR2	:	-----						
Rh-EcR3	:	-----						
A._americanum-EcRA1	:	-----						--
A._americanum-EcRA2	:	-----						..DDALQLGS.AEQQ
A._americanum-EcRA3	:	-----						
B._mori-EcRB1	:	-----MRVENVDNVS-----						FALNGRADEWC..VETRLDSL.V.EK
B._mori-EcRB2	:	-----MRVENVDNVS-----						FALNGRADEWC..VETRLDSL.V.EK
D._melanogaster-EcRA	:	-----MLTTSGQQQSKQKLSTLP---						SHILLQQQLAASAGPSSSVS.SPS.S
D._melanogaster-EcRB1	:	MKRRWSNNGGFMRLLPEESSSEVTSSSNGLVLP SGVNMSPSLLDSHDYCDQLWL CGNESGSFGGSNGHG.SQQQQ						
D._melanogaster-EcRB2	:	-----						
H._asiaticum-EcR	:	-----						
I._scapularis-EcR	:	-----						
O._moubata-EcR	:	-----						.DADSLR.QTQG.PR
D._rerio-LXRa	:	-----MSTLSAT						
H._sapiens-LXRa	:	-----						
M._musculus-LXRb	:	-----						--MSSPT.S

		80	*	100	*	120	*	140	*	
Rh-EcR1	:	AAAAAPSSDEVASMKPMLLQAAQG-AGG-----						LAAGSPPALSPNLPSVVKVEPRLP		
Rh-EcR2	:	-----MAGHLVP-----						PAMNYH.GYEE.PPPYVVP-		
Rh-EcR3	:	-----								
A._americanum-EcRA1	:	S.....G.....								
A._americanum-EcRA2	:	LD.HLLELAA..LHGLAR.FV.AKRDER-----						.LLATHD.HTAHRD.EP..VAAD		
A._americanum-EcRA3	:	-----						--MNYH.GYED.PPPYTAAA		
B._mori-EcRB1	:	SEVK.YVGGCPSV.TDAGAYD.LFDMRRRWSN-----						-NGGFPLRM.EES.SEVT.SSALG.PPAMVMS.		
B._mori-EcRB2	:	SEVK.YVGGCPSV.TDAGAYD.LFDMRRRWSN-----						-NGGFPLRM.EES.SEVT.SSALG.PPAMVMS.		
D._melanogaster-EcRA	:	.LTLHVASANGGA.ET TSA..VKDKLRPTPTAIKIEPMPDVISVGT VAGGSSVA.VV.PAATTT.NKPNSTAA.								
D._melanogaster-EcRB1	:	SVITLAMHGCS..PAQTTIIPINGNANGNGGSTNGQYVPGATNLGALANG-MLNGGFNGMQQQIQNGHGLINST								
D._melanogaster-EcRB2	:	-----								
H._asiaticum-EcR	:	-----								
I._scapularis-EcR	:	-----								
O._moubata-EcR	:	QSNHQYR.TL.SVQP.QP.RC.SHG.PNGLLYLATEGMPPPGLRGDAGGALAGQA.....								
D._rerio-LXRa	:	DITDVGHG.S.GCDSEEGPS..MA-----						-EVKQEILSQT..YNTSHDDLNDS		
H._sapiens-LXRa	:	--MPHSAGGTAGVGLAAEPT.LL-----						-TRAE..SEPTE.R-----		
M._musculus-LXRb	:	LDP TV.GNGSP-QPSTSATSPTIK-----						-EE.QETDPP.GSEGSSSAYIVE.		

		160	*	180	*	200	*	220
Rh-EcR1	:	SPCVGG-----AAS-DG--VPQKRVRQDDAGAWISSPSSQMSVGSLSPPPPLLNGLANSSGLSPVS-CSSYE						
Rh-EcR2	:	-EDFWR-----						
Rh-EcR3	:	-----						
A._americanum-EcRA1	:	G..GP..P.....						N....D
A._americanum-EcRA2	:	VQR.CRPGQVLQTDGDDG..GP..P.....						N....D
A._americanum-EcRA3	:	PEDFWR-----						
B._mori-EcRB1	:	ESLASPEYR---ALELWSYDDGITYNTA.SLL..CNMQQQQLQPQQPHPA..T.PTMPLMPPT..K.ENE.MS						
B._mori-EcRB2	:	ESLASPEYR---ALELWSYDDGITYNTA.SLL..CNMQQQQLQPQQPHPA..T.PTMPLMPPT..K.ENE.MS						
D._melanogaster-EcRA	:	.TSAAAANG---HLVLVPNKRPRLDVTEDWMSTPSPG.VP.SAPPL.P..GSQNHSYNMSNGYA...AG.YDP						
D._melanogaster-EcRB1	:	..STPTTPL---HLQQNL.GAGGGGIGMGILHHANG..NGL.G.VGGGGVG.GV.GGGVG..GMQHTPR.DS						
D._melanogaster-EcRB2	:	-----M..C..VAELAHYIDA						
H._asiaticum-EcR	:	-----						
I._scapularis-EcR	:	-----						
O._moubata-EcR	:	SS-----,DGMAYS.S.....S..A..G....						L.NGTANS.NNGLSPAS....D
D._rerio-LXRa	:	ML-----						
H._sapiens-LXRa	:	-----						
M._musculus-LXRb	:	-----						

		*	240	*	260	*	↓	↓	280	*	↓	↓	300
Rh-EcR1	:	TYSRPGPCKEEMSPSSGGGGMNGYFVDSFGDPKK-KKGPAPRQQ-EELCLVCGDRASGYHYNAALTCGCKGFFRR											
Rh-EcR2	:												
Rh-EcR3	:												
A._americanum-EcRA1	:												
A._americanum-EcRA2	:												
A._americanum-EcRA3	:												
B._mori-EcRB1	:	.----G.....A.S---...CSA.A--A..Q.....											
B._mori-EcRB2	:	.----G.....A.S---...CSA.A--A..Q.....											
D._melanogaster-EcRA	:	YSPTGKTG.DD.....S---...SA.ESC.A..S.....V..											
D._melanogaster-EcRB1	:	VN.I-SSG.DD.....S---...SA.ESC.A..S.....V..											
D._melanogaster-EcRB2	:	Y----G.DD.....S---...SA.ESC.A..S.....V..											
H._asiaticum-EcR	:	-----											
I._scapularis-EcR	:	-----											
O._moubata-EcR	:												
D._rerio-LXRa	:	-ESNDIKMFFREDKAAPE.Q.V.R.....MLGN..S.....V..											
H._sapiens-LXRa	:	-----Q.R.....MLGN..S.....V..											
M._musculus-LXRb	:	-----EDEPE..R.....MLGH..R.....V..											

Rh-EcR1 : SITKN--AVYQCKYGNNCIDIMYMRKQC^{*}ECRLKKCL³²⁰SVGMRPECVVP^{*}EYQCAIKRESKKHKD--RPNSTTRES
 Rh-EcR2 :
 Rh-EcR3 :
 A._americanum-EcRA1 :
 A._americanum-EcRA2 :
 A._americanum-EcRA3 :
 B._mori-EcRB1 :I...HA...E...A...Q...PS.NKD.QR...--K.KGILLP
 B._mori-EcRB2 :I...HA...E...A...Q...PS.NKD.QR...--K.KGILLP
 D._melanogaster-EcRA :S...C...RA...E...A...N...RE...A...E--K.KM.TSP
 D._melanogaster-EcRB1 :S...C...RA...E...A...N...RE...A...E--K.KM.TSP
 D._melanogaster-EcRB2 :S...C...RA...E...A...N...RE...A...E--K.KM.TSP
 H._asiaticum-EcR :
 I._scapularis-EcR :KD...
 O._moubata-EcR :A...KD...D-
 D._rerio-LXRa :I...G...Q...S...NSGR...E...REA...LE...S...E...IR...MK...QE...ET-----
 H._sapiens-LXRa :I...G...H...I...HS...GH...P...T...RQA...E...S...E...IR...LK...QE...EQ-----
 M._musculus-LXRb :VHGGAGR...A...GSGT...Q...A...L...KEA...E...S...E...IRK...IQ...QQ...QQ-----

Rh-EcR1 : PSGLMAPSS-----MGGGVSPSSQPLGGGGSSLSGNSNHEEDKKPLVLSPGVKPLTSSQEDLINKLV
 Rh-EcR2 :
 Rh-EcR3 :
 A._americanum-EcRA1 :A.....
 A._americanum-EcRA2 :A.....
 A._americanum-EcRA3 :A.....
 B._mori-EcRB1 : V-----TTTVEDH.PPI.QCDPP.PEAARIHEVVPRYLS.KLMEQNRQKN.P...AN.KS.A...
 B._mori-EcRB2 : V-----TTTVEDH.PPI.QCDPP.PEAARIHEVVPRYLS.KLMEQNRQKN.P...AN.KS.A...
 D._melanogaster-EcRA : S.QHGGNG.LASGGGQDFVKKE.LDL..CEPPQ-----HATIP-LLPDEILAKCQARN.PS..YN.LA..Y...
 D._melanogaster-EcRB1 : S.QHGGNG.LASGGGQDFVKKE.LDL..CEPPQ-----HATIP-LLPDEILAKCQARN.PS..YN.LA..Y...
 D._melanogaster-EcRB2 : S.QHGGNG.LASGGGQDFVKKE.LDL..CEPPQ-----HATIP-LLPDEILAKCQARN.PS..YN.LA..Y...
 H._asiaticum-EcR :S.....PNQN...
 I._scapularis-EcR : .ATS.G..PGPPPPSGMGGGMP..NSN.S..NN.S.....VQLMEP.-.....
 O._moubata-EcR : -A.P.T.G.-.....A...RES...-GSD...K.PI..AMT...A.....
 D._rerio-LXRa :ART...VAT--PSPAPEMPP-----APE...E...E...
 H._sapiens-LXRa :AHA...L.PRASSPPQILPQ-----PE.LG...E...
 M._musculus-LXRb :PP.P...AASSGRPAASPGTS..ASSQGSGELEGIO...AA...L...QQ...

Rh-EcR1 : YYQQEFESFSEEDMKKTP--FPLGDSEEDNQRRFQHTEITILTQVLIVEFSKRVPGFDTLAREDDITLLKAC
 Rh-EcR2 :
 Rh-EcR3 :
 A._americanum-EcRA1 :
 A._americanum-EcRA2 :
 A._americanum-EcRA3 :
 B._mori-EcRB1 : ...G...Q...D...V...QT--QSDEED.ESDLP.RQ...A.G...SK.SQS...S
 B._mori-EcRB2 : ...G...Q...D...V...Q---SDEED.ESDLP.RQ...A.G...SK.SQS...S
 D._melanogaster-EcRA : ...DG...Q...IMS---QPDEN.SQTDVS.R...A.G...A.TK.PQ...
 D._melanogaster-EcRB1 : ...DG...Q...IMS---QPDEN.SQTDVS.R...A.G...A.TK.PQ...
 D._melanogaster-EcRB2 : ...DG...Q...IMS---QPDEN.SQTDVS.R...A.G...A.TK.PQ...
 H._asiaticum-EcR :
 I._scapularis-EcR :
 O._moubata-EcR :L...
 D._rerio-LXRa : AM.K.CNKR.FI.RP.V..WPQSQDPQNR.VR.Q..A.F...A...E...D.A.Q...LE.T...A...TS
 H._sapiens-LXRa : AA...CNKR.FS.RL.V..WPMA.DPH.R.AR.Q..A.F...A...E...D.A.Q...LQ.S...A...TS
 M._musculus-LXRb : AA...L.CNKR.FS.QP.V..WPLGADPQ.RDAR.Q..A.F...A...E...D.A.Q...LQ.G...A...S

Rh-EcR1 : SSEVMMLRGARKYDVKTDSIVFANNQPYTRDNYRSASVG-DSADALFRFCRKMCLRVDAEYALLTAIVIFS-E
 Rh-EcR2 :
 Rh-EcR3 :
 A._americanum-EcRA1 :
 A._americanum-EcRA2 :
 A._americanum-EcRA3 :
 B._mori-EcRB1 :V...AA...KA...QGG-A-YVIED.LH...C.FA.G...VH...-D
 B._mori-EcRB2 :V...AA...KA...QGG-A-YVIED.LH...C.FA.G...VH...-D
 D._melanogaster-EcRA :M...HS...F...RS...S...M.G.A-NIED.LH...Q.FS...V...-D
 D._melanogaster-EcRB1 :M...HS...F...RS...S...M.G.A-NIED.LH...Q.FS...V...-D
 D._melanogaster-EcRB2 :M...HS...F...RS...S...M.G.A-NIED.LH...Q.FS...V...-D
 H._asiaticum-EcR :
 I._scapularis-EcR :
 O._moubata-EcR :
 D._rerio-LXRa : ...I...ETS...PAI...T.LK.FT.N.E.AK.G.QLEFI.P...E.S.G.ND.H.E...I.N...AD
 H._sapiens-LXRa : ...AI...ETS...PG.E...T.LK.FS.N.E.AK.G.QVEFI.P...E.S.A.N.Q...I.S...AD
 M._musculus-LXRb : ...I...ET...HE.EC.T.LK.FT...HR.G.QVEFI.P...E.S.A.RR.G...I.N...AD

Rh-EcR1	: -----
Rh-EcR2	: -----
Rh-EcR3	: -----
A._americanum-EcRA1	: -----
A._americanum-EcRA2	: -----
A._americanum-EcRA3	: -----
B._mori-EcRB1	: -----
B._mori-EcRB2	: -----
D._melanogaster-EcRA	: EHSTTA
D._melanogaster-EcRB1	: EHSTTA
D._melanogaster-EcRB2	: EHSTTA
H._asiaticum-EcR	: -----
I._scapularis-EcR	: -----
O._moubata-EcR	: -----
D._rerio-LXRα	: -----
H._sapiens-LXRα	: -----
M._musculus-LXRβ	: -----

Additional file1: Figure S1. Alignment of the deduced amino acid sequences of *Rhipicephalus haemaphysaloides* EcR; *Amblyomma americanum* EcR; *Ixodes scapularis*-EcR; *Ornithodoros moubata*-EcR; *Bombyx mori* EcR; *Drosophila melanogaster* EcR; *Danio rerio*-LXRα; *Homo sapiens*-LXRα; *Mus musculus*-LXRβ. All species had a DBD domain and a LBD domain and the DBD domain had two conserved C4-type Zinc finger motifs. Especially, the position of four cysteine residues in the C4_ZnF was highly conservative. In arthropods, the DBD and LBD domain were relatively conserved.