Table S1. List of primers used in this study for Real Time PCR.

Primer*	Primer sequence (5'→3')	Annealing temp (°C)	Amplicon (bp)
RePEPCK_FP	TCTCACCAGCTGATCTCGAC	55	174
RePEPCK_RP	GTGTCATGATACGCATGCAA		
ReBA_FP	TCCAAGACAGCCGTGCAGTG	60	184
ReBA_RP	GGGCCACACGGAGTTCATTG		

*Abbreviations: RePEPCK-phosphoenolpyruvate carboxykinase from *Raillietina echinobothrida*; FP-forward primer; RP-reverse primer; ReBA-β-actin from *R. echinobothrida*.

Table S2. Comparison of optimal parameters of enzyme kinetics between recombinant and native PEPCKs originated from the parasite and its host, respectively. Specific activity is expresssed as U per mg of protein.

Parameters	recombinant RePEPCK	native RePEPCK*	recombinant GdPEPCK	native GdPEPCK**	recombinant GdPEPCK	native GdPEPCK**
	carboxylation	carboxylation	carboxylation	carboxylation	decarboxylation	decarboxylation
Mol. wt. (kDa)	70	65	70	68	70	68
Amino acids	628	-	622	607	607**	607
Buffers (50 mM)						
Tris-HCl, pH 7.4	23.0 ± 1.5	29.6 ± 3.4	14.0 ± 0.5	-	-	-
HEPES, pH 7.4	-	-	-	-	32.7 ± 1.5	-
Imidazole, pH 7.4	-	-	-	17.9	-	36.1
Metal ions (4 mM)						
$MgCl_2$	-	-	-	-	33.9 ± 1.3[a]	-
$MnCl_2$	21.0 ± 1.3	28.42 ± 4.2	14.0 ± 0.7	-	33.1 ± 1.2[b]	-
Nucleotides						
ADP	-	-		-	32.6 ± 0.9[c]	-
GDP	22.1 ± 1.1[e]	28.13 ± 3.5	14.0 ± 0.6[f]	-	-	-
GTP	-	-		-	33.3 ± 0.01[d]	-

*Das *et al*. (2013). *Parasitology* **140,** 136-146.
Sato *et al*. (1986). *Biochemistry* **100, 671-678.
[a] different metal ions (5.8 mM) were used for GdPEPCK decarboxylation reaction at constant $MnCl_2$ (0.02 mM).
[b] different metal ions (0.02 mM) were used for GdPEPCK decarboxylation reaction at constant $MgCl_2$ (5.8 mM).
[c] different nucleoside di-phosphates (1 mM) were used for GdPEPCK decarboxylation reaction at constant GTP (0.45 mM).
[d] different nucleoside tri-phosphates (0.45 mM) were used for GdPEPCK decarboxylation reaction at constant ADP (1 mM).
[e] nucleotides were used at constant concentration of 0.5 mM in carboxylation reaction for RePEPCK.
[f] nucleotides were used at constant concentration of 0.6 mM in carboxylation reaction for GdPEPCK.

Table S3. Effect of different buffers and metal ions on kinetics of RePEPCK* and GdPEPCK.

Test materials (buffers/metal ions)	RePEPCK activity (U/mg of protein)	GdPEPCK activity (U/mg of protein)	
	carboxylation	carboxylation	decarboxylation
Buffers (50 mM)			
HEPES, pH 7.4	11.6 ± 0.7	11.35 ± 0.5	32.7 ± 1.5
Imidazole, pH 7.4	8.2 ± 0.9	9.08 ± 0.3	15.46 ± 1.2
K-acetate, pH 5.2	20.8 ± 1.3	5.67 ± 0.5	-
Na-acetate, pH 5.2	19.7 ± 1.1	5.29 ± 0.7	-
Tris-HCl, pH 7.4	23 ± 1.5	14 ± 0.5	25.94 ± 1
Divalent metal ions (4 mM)			
$CaCl_2$	2.4 ± 0.5	6.56 ± 0.3	4.7 ± 1.2[a]/12.26 ± 0.9[b]
$CoCl_2$	6.9 ± 0.6	3.8 ± 0.2	7.72 ± 0.8[a]/9.97 ± 1.5[b]
$CuCl_2$	5.4 ± 0.5	-	2.82 ± 1.4[a]/5.56 ± 0.4[b]
$HgCl_2$	3 ± 0.7	3.45 ± 0.4	-
$MgCl_2$	12.5 ± 0.7	8.12 ± 0.5	33.9 ± 1.3[a]
$MnCl_2$	21 ± 1.3	14 ± 0.7	33.1 ± 1.2[b]
$NiCl_2$	2.4 ± 0.6	6.39 ± 0.2	2.91 ± 0.9[b]
$ZnCl_2$	4.5 ± 0.4	2.41 ± 0.3	4.85 ± 0.5[b]

*decarboxylation reaction was not observed for RePEPCK.
[a] different metal ions (5.8 mM) were used for GdPEPCK decarboxylation reaction at constant $MnCl_2$ (0.02 mM).
[b] different metal ions (0.02 mM) were used for GdPEPCK decarboxylation reaction at constant $MgCl_2$ (5.8 mM).

Table S4. Effect of different nucleotides on kinetics of RePEPCK and GdPEPCK.

Nucleotides	RePEPCK activity (U/mg of protein)	GdPEPCK activity (U/mg of protein)	
	carboxylation (0.5 mM)	carboxylation (0.6 mM)	decarboxylation
AMP	3.5 ± 0.4	-	-
GMP	2.4 ± 0.3	2.13 ± 0.4	-
UMP	2.2 ± 0.3	-	-
TMP	2.6 ± 0.5	2.52 ± 0.5	-
ADP	4.5 ± 1.2	5.05 ± 0.3	32.6 ± 0.9[a]
CDP	-	-	2.94 ± 1.1[a]
GDP	22.1 ± 1.1	14 ± 0.6	6.65 ± 1[a]
TDP	-	-	1.51 ± 0.5[a]
UDP	-	-	-
ATP	2.4 ± 0.0	5.25 ± 0.2	8.32 ± 0.8[b]
CTP	4.8 ± 0.5	7.19 ± 0.5	-
GTP	2.3 ± 0.7	1.94 ± 0.2	33.3 ± 0.01[b]
TTP	1.8 ± 0.2	-	-
UTP	2.4 ± 0.5	-	-

[a] different nucleoside di-phosphates (1 mM) were used for GdPEPCK decarboxylation reaction at constant GTP (0.45 mM).
[b] different nucleoside tri-phosphates (0.45 mM) were used for GdPEPCK decarboxylation reaction at constant ADP (1 mM).

Table S5. Kinetics of RePEPCK and GdPEPCK in carboxylation and decarboxylation direction. Apparent Michaelis constants (Km_{app})* for the substrates and other co-factors for RePEPCK and GdPEPCK. Lineweaver-Burk plot was used for the determination of Km_{app} of RePEPCK and GdPEPCK. Comparison of Km_{app} of recombinant and native PEPCK from the parasite and its host, respectively.

Substrate or co-factors	recombinant RePEPCK	native RePEPCK*	recombinant GdPEPCK	native GdPEPCK**	recombinant GdPEPCK	native GdPEPCK**
	carboxylation	carboxylation	carboxylation	carboxylation	decarboxylation	decarboxylation
PEP (GDP)	0.047	0.043	0.023	0.026	-	-
OAA (GTP)	-	-	-	-	0.015	0.012
GDP	0.1	0.025	0.067	0.021	-	-
ADP	-	-	-	-	0.062	-
GTP	-	-	-	-	0.084	0.016
HCO_3^-	2.8	4.8	1.9	0.017	-	-
Mn^{2+}	0.12	-	0.17	-	0.012	-
Mg^{2+}	-			-	2.8	

*Das *et al*. (2013). *Parasitology* **140,** 136-146.
Sato *et al*. (1986). *Biochemistry* **100, 671-678.

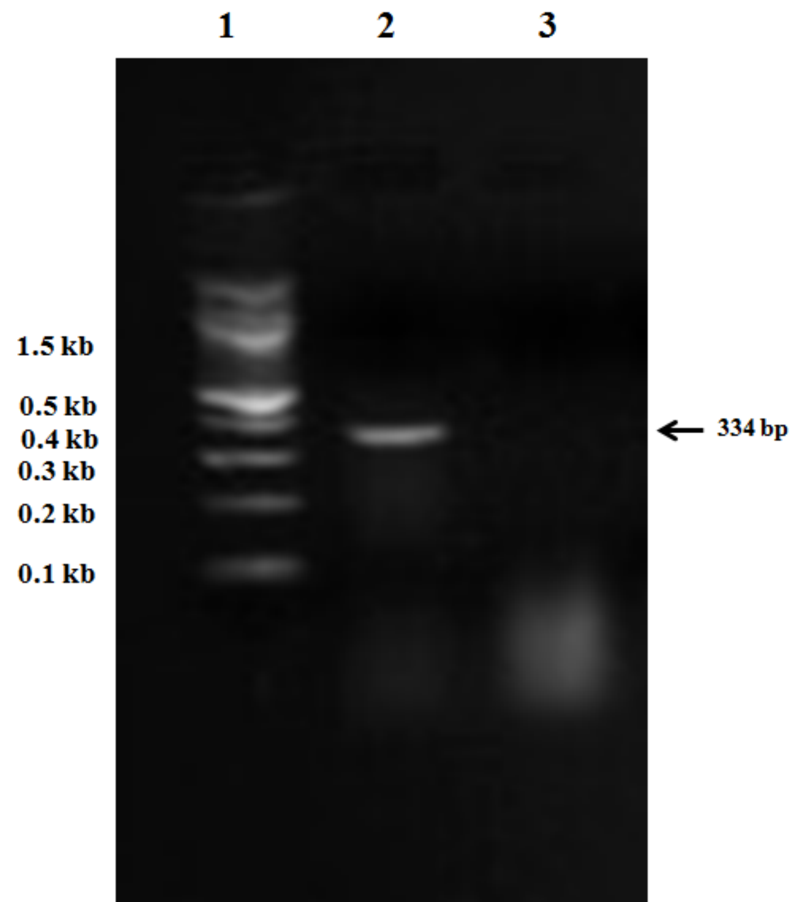

Fig. S1. Analysis of β-actin transcript from *R. echinobothrida*. The transcript was PCR amplified and analyzed on 2 % agarose gel: lane 1, 100 bp DNA ladder; lane 2, PCR amplicon of β-actin transcript showing 334 bp; lane 3, negative control.

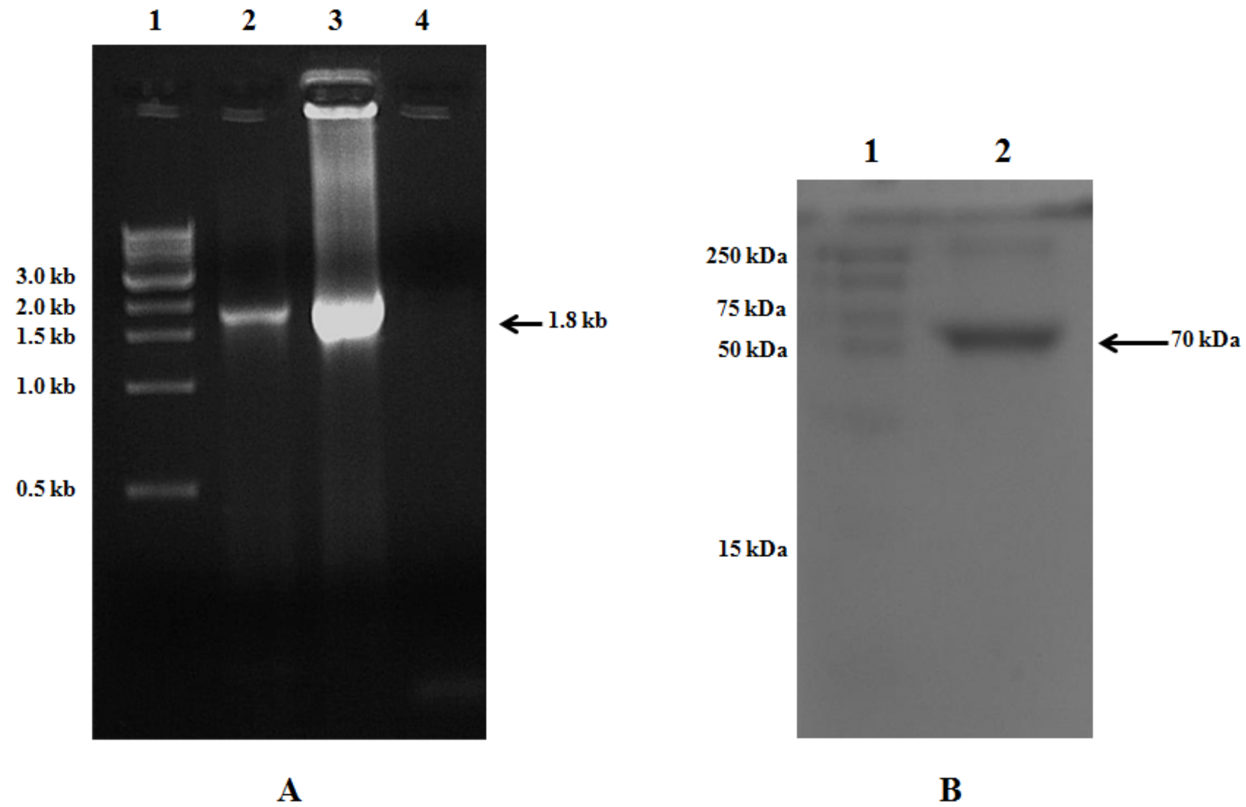

Fig. S2. (A) Amplification of ORF of PEPCK from *R. echinobothrida*. Agarose gel (1.2 %) analysis for confirmation of positive clones having pE-SUMO-RePEPCK plasmids: lane 1, 1 kb DNA ladder; lane 2, ORF of RePEPCK showing band size of 1.8 kb; lane 3, amplification of ORF of RePEPCK using PCR products as template; lane 4, negative control. (B) Purification of RePEPCK: lane 1, molecular weight marker; lane 2, purified RePEPCK.

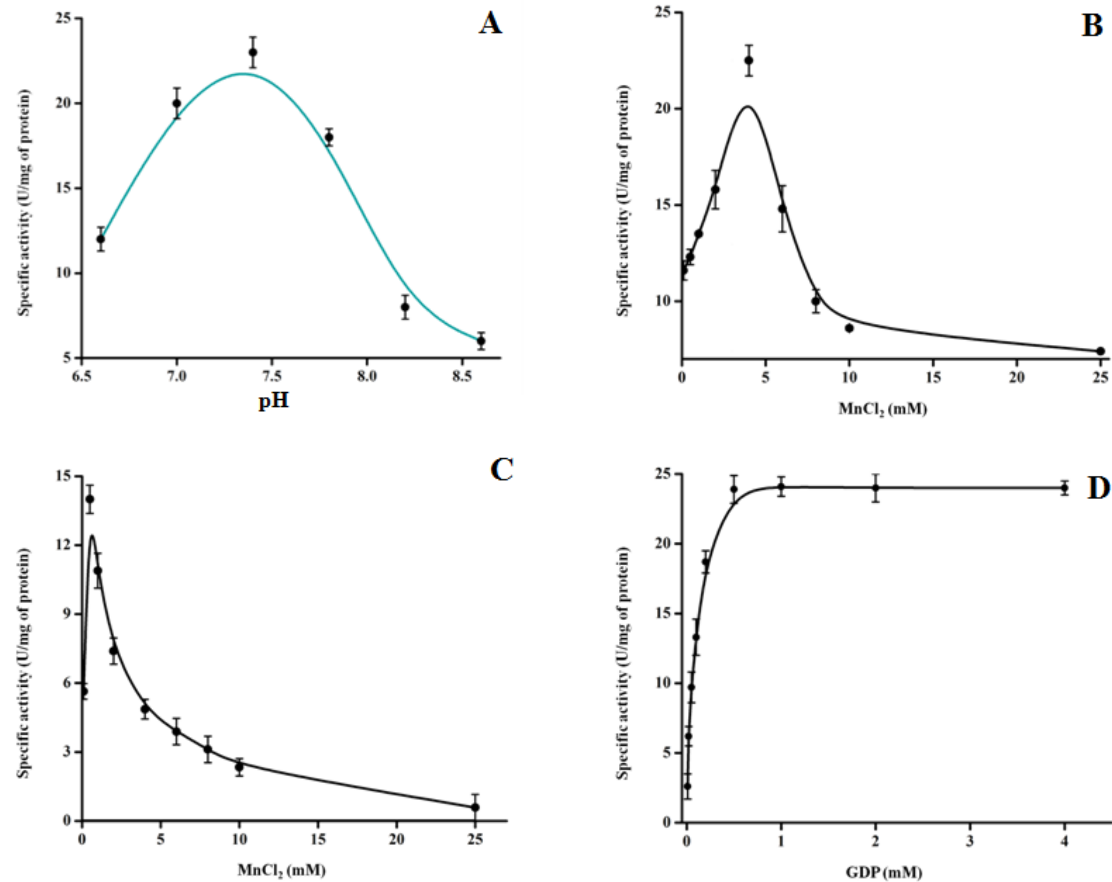

Fig. S3. (A) Effect of different pH (6.5 to 8.6) of Tris-HCl buffer (50 mM) on RePEPCK activity. Values are taken from 3 separate experiments and expressed as mean ± S.E.M. (B) Effect of different concentrations (0.1 mM to 25 mM) of $MnCl_2$ on RePEPCK activity (carboxylation). Values are taken from 3 separate experiments and expressed as mean ± S.E.M. (C) Effect of different concentrations (0.1 mM to 25 mM) of $MnCl_2$ on GdPEPCK activity (carboxylation). Values are taken from 3 separate experiments and expressed as mean ± S.E.M. (D) Effect of different concentrations (0.01 mM to 4 mM) of di-nucleotide guanosine di-phosphate (GDP) on RePEPCK activity. Values are taken from 3 separate experiments and expressed as mean ± S.E.M.

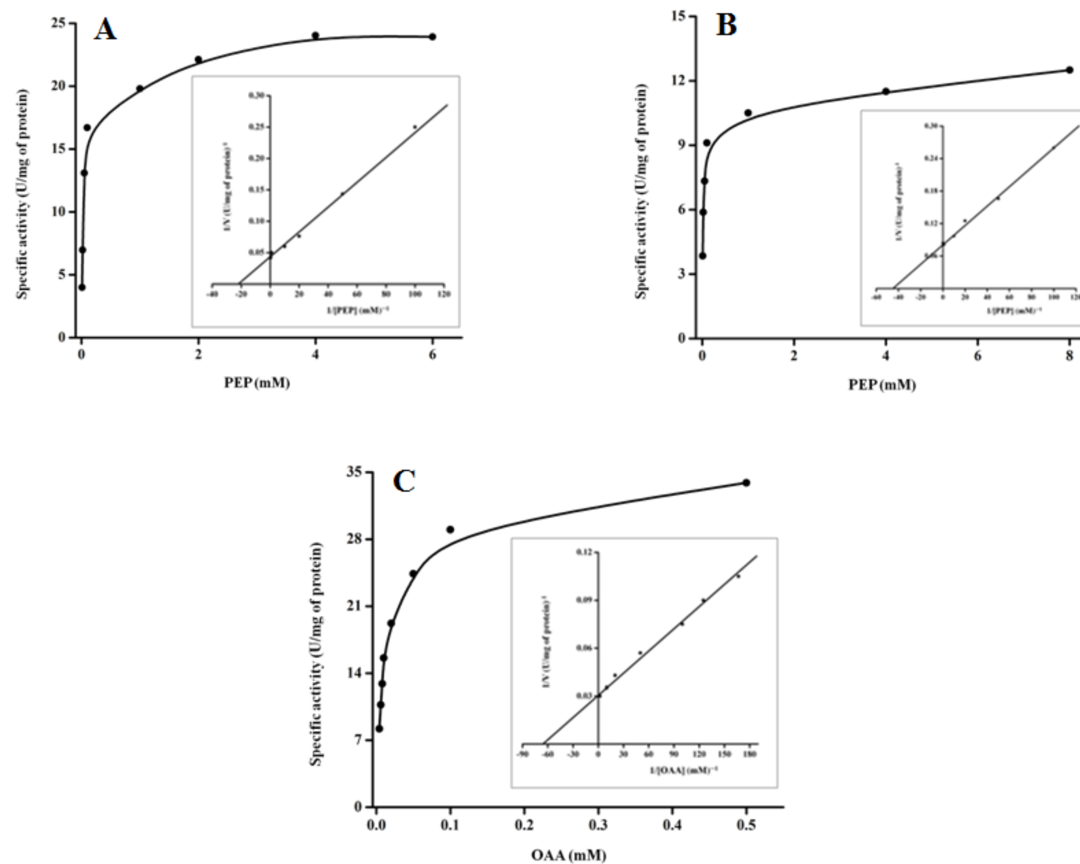

Fig. S4. (A) Michaelis-Menten plot showing *V*max of RePEPCK activity in presence of PEP. Lineweaver-Burk plot showing Km_{app} = 46.9 µM for PEP in the case of RePEPCK (carboxylation). The plot was calculated from assays of seven different concentrations of PEP (0.01 mM to 8 mM). The intercept on the X-axis -1/*K*m shows positive correlation with R^2 = 0.9949 under standard assay conditions (inset). (B) Michaelis-Menten plot showing *V*max of GdPEPCK activity in presence of PEP (carboxylation). Lineweaver-Burk plot showing Km_{app} = 22.9 µM for PEP in the case of GdPEPCK (carboxylation). The plot was calculated from assays of seven different concentrations of PEP (0.01 mM to 8 mM). The intercept on the X-axis -1/*K*m shows positive correlation with R^2 = 0.9979 under standard assay conditions (inset). (C) Michaelis-Menten plot showing *V*max of GdPEPCK activity in presence of OAA (decarboxylation). Lineweaver-Burk plot showing Km_{app} = 15.4 µM for OAA in the case of GdPEPCK (decarboxylation). The plot was calculated from assays of seven different concentrations of OAA (0.006 mM to 0.5 mM). The intercept on the X-axis -1/*K*m shows positive correlation with R^2 = 0.9994 under standard assay conditions (inset).

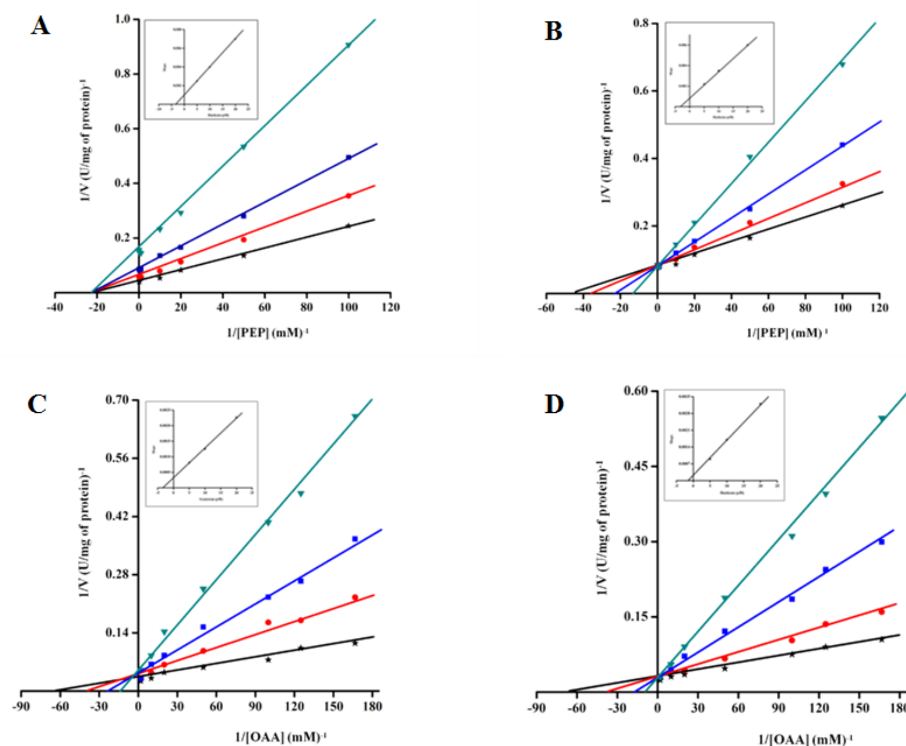

Fig. S5. (A) Lineweaver-Burk plot showing inhibition of RePEPCK activity (carboxylation) by daidzein at variable substrate concentrations. The plot was calculated from assays of seven different concentrations of PEP (0.01 mM to 8 mM) in the presence of three different concentrations of daidzein {(★) control, (●) 5 µM, (■) 10 µM, and (▼) 20 µM}. The replot of the slope of the lines in the Lineweaver-Burk plot versus daidzein concentrations shows K_i = 0.26 µM and positive correlation with R^2 = 0.9985 under standard assay conditions (inset). (B) Lineweaver-Burk plot showing inhibition of GdPEPCK activity (carboxylation) by daidzein at variable substrate concentrations. The plot was calculated from assays of seven different concentrations of PEP (0.01 mM to 8 mM) in the presence of three different concentrations of daidzein {(★) control, (●) 5 µM, (■) 10 µM, and (▼) 20 µM}. The replot of the slope of the lines in the Lineweaver-Burk plot versus daidzein concentrations shows 0.35 µM and positive correlation with R^2 = 0.9918 under standard assay conditions (inset). (C) Lineweaver-Burk plot showing inhibition of GdPEPCK activity (decarboxylation) by genistein at variable substrate concentrations. The plot was calculated from assays of seven different concentrations of OAA (0.006 mM to 0.5 mM) in the presence of three different concentrations of genistein {(★) control, (●) 5 µM, (■) 10 µM, and (▼) 20 µM}. The replot of the slope of the lines in the Lineweaver-Burk plot versus genistein concentrations shows 0.31 µM and positive correlation with R^2 = 0.9981 under standard assay conditions (inset). (D) Lineweaver-Burk plot showing inhibition of GdPEPCK activity (decarboxylation) by daidzein at variable substrate concentrations. The plot was calculated from assays of seven different concentrations of OAA (0.006 mM to 0.5 mM) in the presence of three different concentrations of daidzein {(★) control, (●) 5 µM, (■) 10 µM, and (▼) 20 µM}. The replot of the slope of the lines in the Lineweaver-Burk plot versus daidzein concentrations shows 0.64 µM and positive correlation with R^2 = 0.9987 under standard assay conditions (inset).

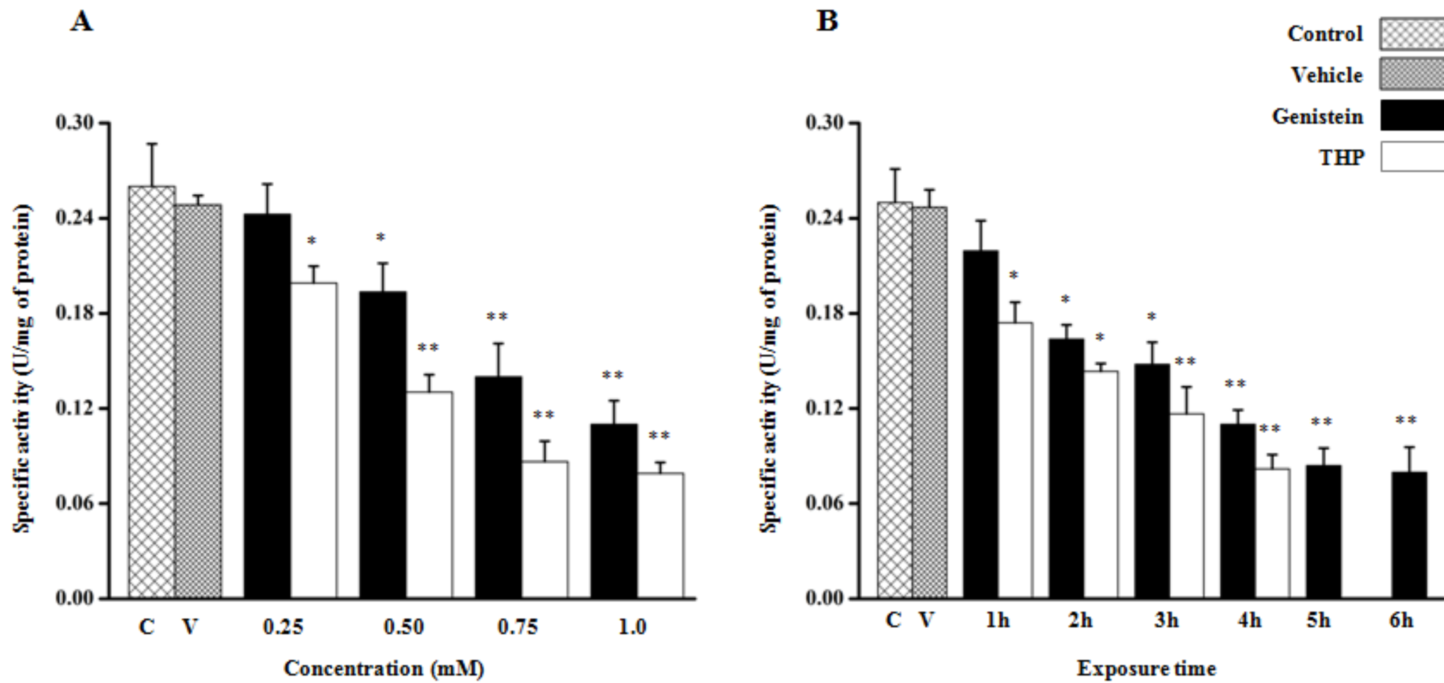

Fig. S6. A comparative dosage- and time- dependent effect of genistein and THP on RePEPCK activity. Genistein and THP modulate PEPCK specific activity (U/mg of protein) in *R. echinobothrida*. *,** signify statistical significance in treated parasites compared to control with *p* value of <0.05 and <0.01, respectively. (A) Genistein and THP declines PEPCK specific activity in *R. echinobothrida* in a dosage dependent manner at 4 h of treatment. (B) Genistein (0.75 mM) and THP (0.75 mM) declines PEPCK specific activity in *R. echinobothrida* in a time dependent manner.