Supplementary materials for

No tillage increases soil microarthropod (Acari and Collembola) abundance at the global scale

Yulin Liu[1,2#], Lihong Song[3#], Donghui Wu[1,2], Zihan Ai[1,2], Qian Xu[1], Xin Sun[2,4,5*], Liang Chang[1,2*]

[1] State Key Laboratory of Black Soil Conservation and Utilization, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun, China.

[2] University of Chinese Academy of Sciences, Beijing, China.

[3] College of Agriculture, Guizhou University, Guiyang 550025, China.

[4] Key Laboratory of Urban Environment and Health, Ningbo Observation and Research Station, Fujian Key Laboratory of Watershed Ecology, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen 361021, China.

[5] Zhejiang Key Laboratory of Urban Environmental Processes and Pollution Control, CAS Haixi Industrial Technology Innovation Center in Beilun, Ningbo 315830, China.

[#]These two authors contribute equally to this paper

[*]**Corresponding author:** Xin Sun, Liang Chang

E-mail: xsun@iue.ac.cn; springtail@iga.ac.cn

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			Multivariate Meta-Analysis Model——Random effects		
			(~1|study)	(~1|reference)	**(~1|reference/study)**
	microarthropod	BIC	2019.3	1543.8	**416.5**
NT	Acari	BIC	2722.3	38670.0	**471.4**
	Collembola	BIC	13615728.1	1414482.7	**544.4**
RT	microarthropod	BIC	**124.3**	730.0	128.1
	Acari	BIC	**185.4**	5751.6	189.3
	Collembola	BIC	**79.0**	199.4	81.8

Table S1. The results of model selection for the random effects structure of soil microarthropods, Acari and Collembola for no tillage and reduced tillage. Models were run with a full fixed effects structure and compared using the Bayesian Information Criterion (BIC). The final random effect's structure used in the meta-analysis is in bold.

Random effects:				Variance Components:		Model Results:			
				reference	reference/study				
(~1|reference/study)		Test for Heterogeneity	P	sigma^2.1	sigma^2.2	estimate	p	ci.lb	ci.ub
	microarthropod	Q(df = 166) = 2455.85	<0.01	0.088	0.403	0.238	<0.01	0.059	0.416
NT	Acari	Q(df = 192) = 99873.78	<0.01	0.161	0.353	0.197	<0.05	0.017	0.377
	Collembola	Q(df = 175) = 13654887.08	<0.01	0.244	0.957	0.284	<0.05	0.045	0.522
(~1|id)		Test for Heterogeneity			study				
	microarthropod	Q(df = 45) = 2322.24	<0.01		0.676	0.253	<0.1	-0.002	0.508
RT	Acari	Q(df = 63) = 17238.18	<0.01		0.681	0.426	<0.01	0.188	0.665
	Collembola	Q(df = 26) = 257.26	<0.01		0.694	-0.034	0.86	-0.400	0.332

Table S2. Model results and tests of heterogeneity for multivariate meta-analysis of no tillage and reduced tillage on soil microarthropods, Acari and Collembola

		Variance Components:					Model Results:			
		reference	reference/study							
NT		sigma^2.1	sigma^2.2	Test of Moderators:			estimate	intercept	ci.lb	ci.ub
microarthropod	Texture	0.0047	0.4522	QM=22.5662	p <0 .01	**				
	pH	0.1055	0.4199	QM=2.8945	p <0.10	.	-0.1409	0.2957	-0.30	0.02
	Organic matter	0.1187	0.3875	QM=0.9183	p = 0.34		0.0314	0.2704	-0.22	0.28
	Total N	0.0252	0.3106	QM=0.0001	p = 0.99		-0.0103	0.1057	-0.16	0.14
	Available P	0.0000	0.4294	QM=22.1947	p <0 .01	**	-0.347	0.1353	-0.49	-0.21
	Available K	0.1578	0.4434	QM=1.0033	p = 0.32		-0.1951	0.2287	-0.58	0.19
	Annual Precipitation	0.0561	0.4808	QM=4.1322	p <0.05	*	0.1638	0.2564	0.02	0.31
	Annual Mean Temperature	0.0903	0.4020	QM=0.3593	p = 0.55		-0.0167	0.2940	-0.21	0.18
	Min Temperature	0.0816	0.4063	QM=0.3168	p = 0.57		0.1041	0.2659	-0.09	-0.29
	Max Temperature	0.0872	0.4044	QM=0.0147	p = 0.97		-0.0123	0.2901	-0.20	0.17
	Wettest Month	0.0856	0.4047	QM=0.1709	p = 0.68		-0.0162	0.2878	-0.18	0.15
	Driest Month	0.0320	0.4077	QM=10.6690	p < 0.01	**	0.2181	0.2389	0.07	0.37
	Altitude	0.1045	0.3787	QM=0.0000	p = 0.99		0.0006	0.2905	-0.18	0.19
Acari	Texture	0.0380	0.3668	QM=21.669	p <0. 01	**				
	pH	0.1577	0.3603	QM=2.6388	p = 0.10		-0.0952	0.2852	-0.28	0.09
	Organic Matter	0.1432	0.4099	QM=0.8049	P = 0.37		0.004	0.2733	-0.17	0.18
	Total N	0.1455	0.2947	QM=0.8477	p = 0.36		0.0093	0.2835	-0.18	0.20
	Available P	0.0653	0.4487	QM=0.5754	p = 0.45		-0.0816	0.1304	-0.29	0.13
	Available K	0.0454	0.4506	QM=0.8762	p = 0.35		0.0975	0.1067	-0.11	0.30
	Annual Precipitation	0.1232	0.3417	QM=4.3991	P<0.05	*	0.1739	0.2651	0.01	0.34
	Annual Mean Temperature	0.1593	0.3467	QM=0.0319	p = 0.86		0.0335	0.2459	-0.15	0.22

	Min Temperature	0.1525	0.3474	QM=0.2061	p = 0.65		0.1137	0.2305	-0.07	0.30
	Max Temperature	0.1509	0.3468	QM=0.6097	p = 0.43		0.0726	0.2506	-0.10	0.25
	Wettest Month	0.1531	0.3461	QM=1.0189	p = 0.31		0.0551	0.2512	-0.10	0.21
	Driest Month	0.1006	0.3483	QM=6.884	p <0.01	**	0.2507	0.2668	0.09	0.41
	Altitude	0.1272	0.3197	QM=2.7729	p = 0.10		-0.1375	0.2584	-0.30	0.02
Collembola	Texture	0.0533	1.0336	QM=15.0740	p < 0.05	*				
	pH	0.2736	1.0007	QM=0.0045	p = 0.94		0.0159	0.3002	-0.24	0.27
	Organic Matter	0.0000	0.9978	QM=4.1771	p <0.05	*	-0.1802	0.3067	-0.38	0.02
	Total N	0.0000	0.9235	QM=3.3455	P<0.10	.	-0.2031	0.3846	-0.43	0.02
	Available P	0.0000	1.6781	QM=0.0002	p = 0.99		0.0027	0.2533	-0.35	0.35
	Available K	0.0000	1.7140	QM=0.0373	p = 0.85		0.0367	0.2363	-0.34	0.41
	Annual precipitation	0.2417	1.0899	QM=0.0774	p = 0.78		-0.0406	0.2943	-0.30	0.22
	Annual Mean Temperature	0.1989	1.1071	QM=0.8074	p = 0.37		0.0159	0.2841	-0.24	0.27
	Min Temperature	0.2424	1.1636	QM=0.0277	p = 0.87		-0.0183	0.2632	-0.28	0.25
	Max Temperature	0.2002	1.1514	QM=0.3747	p = 0.54		-0.1062	0.2492	-0.40	0.19
	Wettest Month	0.2253	1.0935	QM=0.1784	p = 0.67		0.0585	0.2688	-0.19	0.31
	Driest Month	0.2259	1.0949	QM=0.0020	p = 0.96		-0.0377	0.2750	-0.31	0.24
	Altitude	0.2419	1.1400	QM=0.1293	p = 0.72		0.0414	0.2693	-0.18	0.27
RT		Variance	Components: study sigma^2	Test of Moderators:			estimate	intercept	ci.lb	ci.ub
microarthropod	Texture		0.5461	QM=8.8956	p < 0.10	.				
	pH		0.6086	QM=2.2535	p = 0.13		0.2174	0.2512	-0.07	0.5
	Organic Matter		0.6098	QM=2.7710	p < 0.10	.	0.2557	0.2275	-0.05	0.56
	Total N		0.5316	QM=1.2000	p = 0.27		0.1531	0.1776	-0.12	0.43
	Available P		0.6067	QM=2.1910	p = 0.14		-0.2473	0.1705	-0.57	0.08
	Available K		0.6318	QM=2.2011	p = 0.14		-0.2058	0.1539	-0.48	0.07

	Annual Precipitation	0.5961	QM=2.1958	p = 0.14		0.2118	-0.0899	-0.07	0.49
	Annual mean temperature	0.5010	QM=0.3149	p = 0.57		0.0370	-0.0147	-0.09	0.17
	Min temperature	0.6234	QM=1.9339	p = 0.16		0.1731	0.2654	-0.07	0.42
	Max temperature	0.6581	QM=0.0495	p = 0.82		-0.029	0.2524	-0.28	0.23
	Wettest month	0.6575	QM=0.0324	p = 0.86		0.0235	0.2524	-0.23	0.28
	Driest month	0.6207	QM=2.0213	p = 0.16		0.1813	0.2635	-0.07	0.43
	altitude	0.5964	QM=2.2116	p = 0.14		-0.2129	0.2607	-0.49	0.07
Acari	texture	0.2450	QM=49.6611	p <0 .01	**				
	pH	0.3227	QM=13.1862	P <0.01	**	0.4053	0.4403	0.19	0.62
	Organic matter	0.4803	QM=0.5194	p = 0.47		-0.0798	0.4512	-0.3	0.14
	Total N	0.7243	QM=0.5047	p = 0.47		0.0946	0.3226	-0.17	0.36
	Available P	0.3142	QM=9.1070	p < 0.01	**	-0.3026	0.3657	-0.5	-0.11
	Available K	0.6086	QM=3.8747	p < 0.05	*	-0.2371	0.1033	-0.47	0.00
	Annual precipitation	0.4259	QM=3.5780	p < 0.10	.	0.215	0.4398	-0.01	0.44
	Annual mean temperature	0.4848	QM=5.2979	p < 0.05	*	0.1406	0.4368	0.02	0.26
	Min temperature	0.6019	QM=2.7423	p < 0.10	.	0.1925	0.4305	-0.04	0.42
	Max temperature	0.6409	QM=0.0293	p = 0.86		0.019	0.4574	-0.2	0.24
	Wettest month	0.6373	QM=0.2326	p = 0.63		0.0534	0.4620	-0.16	0.27
	Driest month	0.5758	QM=4.5383	p < 0.05	*	0.2474	0.4479	0.02	0.48
	altitude	0.3210	QM=12.4993	p < 0.01	**	-0.3329	0.4714	-0.52	-0.15
Collembola	texture	0.3626	QM=12.5153	p < 0.10	.				
	pH	0.6098	QM=1.8631	p = 0.17		0.3033	-0.1183	-0.13	0.74
	Organic matter	0.6756	QM=0.9980	p = 0.32		0.2318	-0.1561	-0.22	0.69
	Total N	0.4550	QM=3.0791	p < 0.10	.	0.3303	0.1484	-0.04	0.70
	Available P	0.6652	QM=0.6532	p = 0.42		-0.2555	-0.6882	-0.88	0.36
	Available K	0.7905	QM=0.5540	p = 0.46		-0.1551	0.2363	-0.56	0.25

Annual precipitation	0.6715	QM=0.0912	p = 0.76		0.0668	-0.1420	-0.37	0.50
Annual mean temperature	1.3876	QM=5.1612	p < 0.05	*	-0.2419	-0.1420	-0.45	-0.03
Min temperature	0.6865	QM=0.2191	p = 0.64		0.0811	-0.0398	-0.26	0.42
Max temperature	0.5848	QM=3.1741	P<0.10	.	-0.3194	0.0327	-0.67	0.03
Wettest month	0.6857	QM=0.3177	p = 0.57		-0.1117	-0.0201	-0.50	0.28
Driest month	0.6959	QM=0.0511	p = 0.82		-0.0404	-0.0390	-0.39	0.31
altitude	0.6760	QM=0.0631	P = 0.80		-0.0553	-0.1391	-0.49	0.38

Table S3. The results of single-factor mixed-effects meta-analysis: effect size on microarthropod, Acari, and Collembola abundance in no tillage and reduced tillage soils. The analysis considered various factors included soil texture, pH, organic matter, total N, available P, available K, annual precipitation, annual mean temperature, min temperature of coldest month, max temperature of warmest month, precipitation of driest month, precipitation of wettest month, and altitude. Prior to the analysis, all variables, except soil texture, were standardized using Z-score criteria.

A) NT microarthropod:

Models	AICC	weights
annual precipitation + precipitation of driest month ： annual precipitation + annual mean temperature : precipitation of driest month + max temperature of warmest month : annual precipitation + max temperature of warmest month : min temperature of coldest month	388.4	0.0685
annual precipitation + precipitation of driest month : annual precipitation+ max temperature of warmest month : annual precipitation + max temperature of warmest month : min temperature of coldest month	388.6	0.0610
annual precipitation + annual mean temperature : precipitation of driest month + max temperature of warmest month : annual precipitation + max temperature of warmest month : min temperature of coldest month	389.3	0.0428
annual precipitation + precipitation of driest month : annual precipitation + annual mean temperature : annual precipitation + max temperature of warmest month : annual precipitation + max temperature of warmest month : min temperature of coldest month	389.4	0.0420

annual precipitation + annual mean temperature : precipitation of driest month+ max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature+ max temperature of warmest month : min temperature of coldest month	389.4	0.0418
precipitation of driest month + min temperature of coldest month : annual mean temperature	389.4	0.0414
annual precipitation + precipitation of driest month : annual precipitation + min temperature of coldest month : annual precipitation + max temperature of warmest month : annual precipitation + max temperature of warmest month : min temperature of coldest month	389.5	0.0387
annual precipitation + precipitation of driest month : annual precipitation + min temperature of coldest month : precipitation of driest month + max temperature of warmest month: annual precipitation + max temperature of warmest month: min temperature of coldest month	389.5	0.0386
precipitation of driest month + min temperature of coldest month : annual mean temperature + max temperature of warmest month : annual precipitation	389.9	0.0314
annual precipitation + min temperature of coldest month : annual precipitation + max temperature of warmest month : annual precipitation + max temperature of warmest month : min temperature of coldest month	390.0	0.0298

B) NT Acari:

Models	AICC	weights
precipitation of driest month + max temperature of warmest month : annual mean temperature	417.1	0.0766
precipitation of driest month	418.0	0.0503
precipitation of driest month + max temperature of warmest month : annual mean temperature+ max temperature of warmest month : min temperature of coldest month	418.3	0.0428
precipitation of driest month + annual mean temperature + max temperature of warmest month : annual mean temperature	418.4	0.0409
precipitation of driest month + min temperature of coldest month : annual mean temperature+ max temperature of warmest month : annual mean temperature	418.5	0.0382

precipitation of driest month + annual mean temperature : precipitation of driest month + min temperature of coldest month : precipitation of driest month + max temperature of warmest month : annual mean temperature	418.5	0.0381
precipitation of driest month + annual mean temperature : precipitation of driest month + min temperature of coldest month : precipitation of driest month+ max temperature of warmest month : min temperature of coldest month	418.5	0.0380
precipitation of driest month + annual mean temperature : precipitation of driest month + min temperature of coldest month : precipitation of driest month	418.7	0.0354
annual precipitation + precipitation of driest month + max temperature of warmest month : annual mean temperature	418.7	0.0353
precipitation of driest month + precipitation of driest month : annual precipitation + max temperature of warmest month : annual mean temperature	418.7	0.344

C) Collembola:

Models	AICC	weights
max temperature of warmest month : annual precipitation + max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature + max temperature of warmest month : pH	389.3	0.0815
pH : annual mean temperature + max temperature of warmest month : annual precipitation+ max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature	389.4	0.0794
max temperature of warmest month + max temperature of warmest month : annual precipitation + max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature + max temperature of warmest month : pH	390.7	0.0408
max temperature of warmest month + pH : annual mean temperature + max temperature of warmest month : annual precipitation + max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature	390.8	0.0385
annual precipitation + precipitation of driest month : annual precipitation + pH : annual mean temperature + max temperature of warmest month : annual precipitation	391.0	0.0345

Annual mean temperature + max temperature of warmest month : annual precipitation + max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature + max temperature of warmest month : pH	391.1	0.0329
pH + max temperature of warmest month : annual precipitation + max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature	391.2	0.0319
annual mean temperature : annual precipitation + annual mean temperature : precipitation of driest month + pH : annual mean temperature + max temperature of warmest month : annual precipitation + max temperature of warmest month : annual mean temperature	391.2	0.0314
annual mean temperature + pH : annual mean temperature + max temperature of warmest month : annual precipitation+ max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature	391.3	0.0307
annual precipitation + max temperature of warmest month : annual precipitation + max temperature of warmest month : precipitation of driest month + max temperature of warmest month : annual mean temperature + max temperature of warmest month : pH	391.3	0.0299

Table S4. Model selection results for multiple meta-regression models relating no tillage microarthropods, Acari and Collembola abundance effect size to the following moderators.

A) microarthropod

Multivariate Meta-Analysis Model	estimate	se	z	ci.lb	ci.ub	p	
intercept	0.4146	0.1019	4.0699	0.2150	0.6143	<0.01	**
annual precipitation	0.5410	0.1311	4.1250	0.2839	0.798	<0.01	**
annual precipitation : precipitation of driest month	-0.1654	0.0886	-1.8665	-0.3391	0.0083	<0.10	.
precipitation of driest month: annual mean temperature	-0.1260	0.0804	-1.5682	-0.2836	0.0315	0.12	
annual precipitation : max temperature of warmest month	0.4012	0.0941	4.2650	0.2168	0.5856	<0.01	**
max temperature of warmest month : min temperature of coldest month	-0.3268	0.1107	-2.9507	-0.5438	-0.1097	<0.01	**
Test of Moderators: QM(df =5) = 35.7479, p < 0.01							

B) Acari

Multivariate Meta-Analysis Model	estimate	se	z	ci.lb	ci.ub	p	
intercept	0.1866	0.0857	2.1768	0.0186	0.3546	<0.05	*
precipitation of driest month	0.2918	0.0773	3.7747	0.1403	0.4434	<0.01	**
max temperature of warmest month : annual mean temperature	0.1086	0.06	1.8115	-0.0089	0.2262	<0.10	.
Test of Moderators: QM(df = 2) = 15.3898, p < 0.01							

C) Collembola:

Multivariate Meta-Analysis Model	estimate	se	z	ci.lb	ci.ub	p	
intercept	0.2321	0.1417	1.6381	-0.0456	0.5098	0.10	
max temperature of warmest month : annual precipitation	1.5735	0.4245	3.707	0.7416	2.4054	<0.01	**

max temperature of warmest month : precipitation of driest month	-0.9175	0.385	-2.3829	-1.6721	-0.1629	<0.05	*
max temperature of warmest month : annual mean temperature	-0.4488	0.1422	-3.1565	-0.7275	-0.1701	<0.01	**
max temperature of warmest month : pH	-0.2211	0.1367	-1.6178	-0.4889	0.0468	0.10	
Test of Moderators: QM(df = 4) = 24.7071, p < 0.01							

Table S5. Standardized coefficients for the retention terms in the best multiple meta-regression model for microarthropods, Acari and Collembola in no tillage soils.

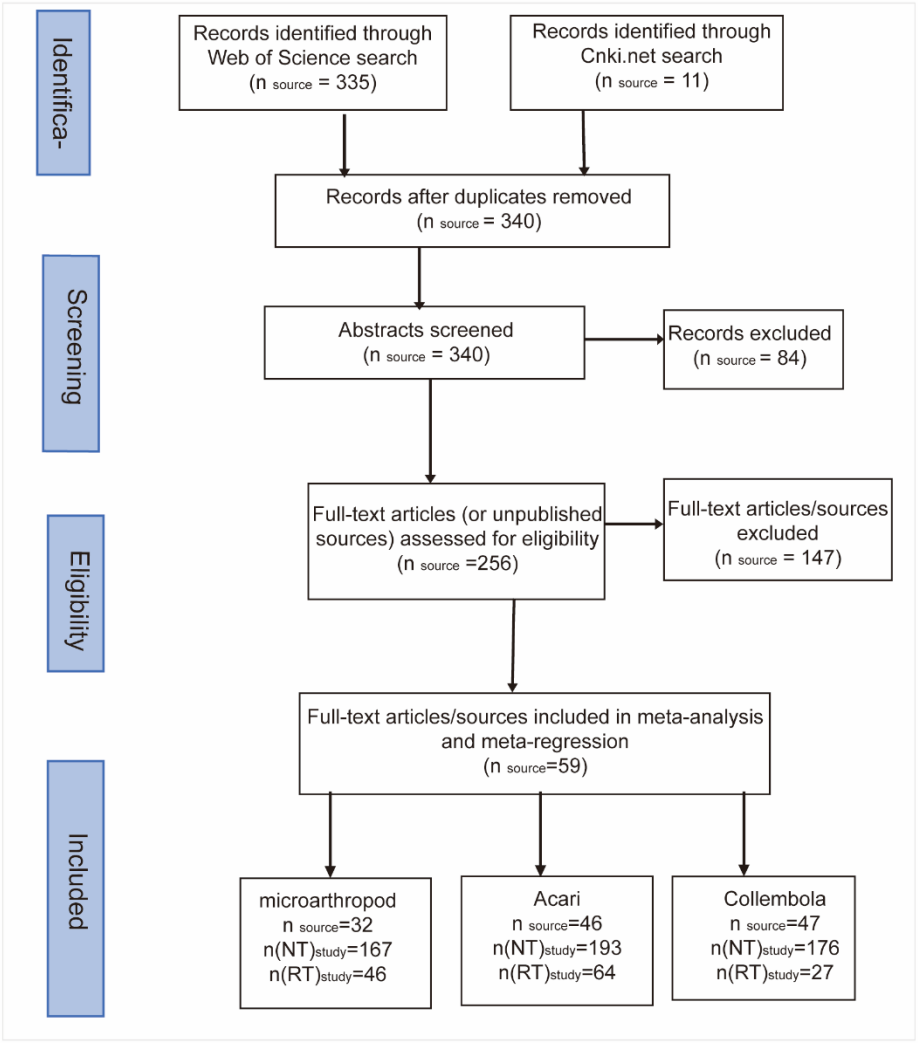

Fig S1. Flow chart showing the procedure of selecting articles

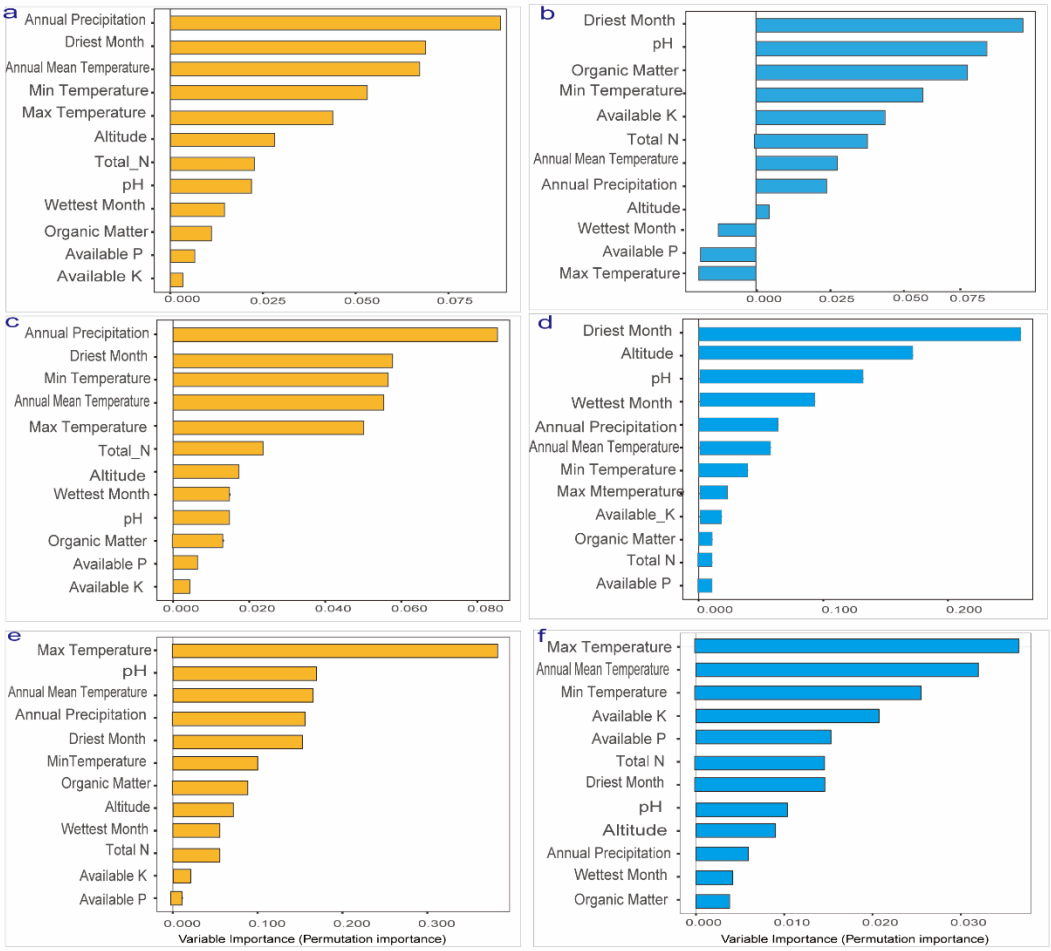

Fig S2. Importance ranking chart for feature variables. These factors included soil texture, pH, organic matter, total N, available P, available K, annual precipitation, annual mean temperature, min temperature of coldest month, max temperature of warmest month, precipitation of driest month, precipitation of wettest month, and altitude.

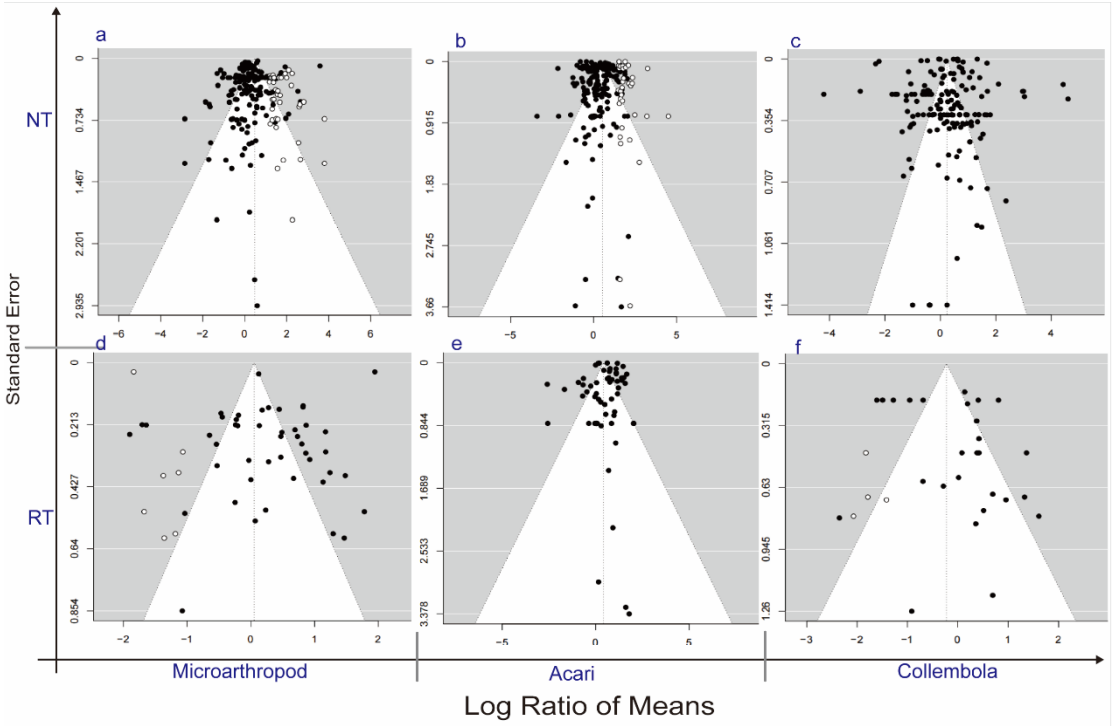

Fig S3. Funnel plots of soil microarthropods, Acari and Collembola in no tillage and reduced tillage. Funnel plot showing the relationship between residuals and precision (1/SE) for meta-analysis. The dashed line is the weighted average effect size (grey). NT for no tillage, RT for reduced tillage; a plot is a no tillage soil microarthropod funnel plot (z=-0.98, p=0.33), b plot is a no tillage soil Acari funnel plot (z=-1.14, p=0.26), c plot is a no tillage soil Collembola funnel plot (z=0.56, p=0.57), d plot is a reduced tillage soil microarthropod fauna funnel plot (z=0.37, p=0.71), e plot is a reduced tillage soil Acari funnel plot (z=-0.75, p=0.44), and f plot is a reduced tillage soil Collembola funnel plot (z=1.41, p=0.16)