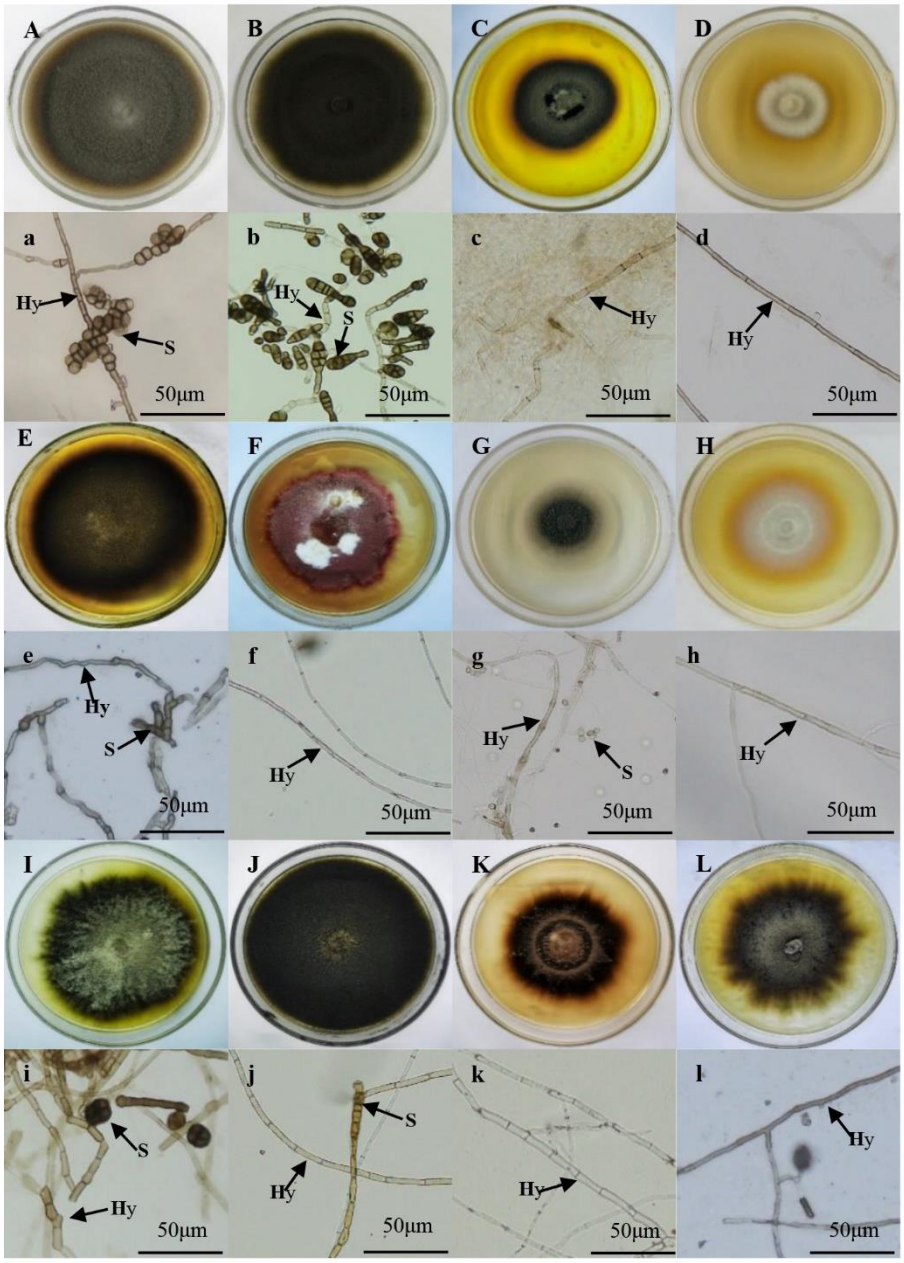


Figure S1. A-L Colonies of endophytic fungi isolated from the roots of *L. ruthenicum*. a-l Microscopic morphology of endophytic fungi. Arrows indicate the following: Hy = DSE hyphae, S = DSE spore. A-E：HGQ-1、2、3、4、5. F-H: HGQ-7、8、9. I-K: HGQ-14、15、16. L: HGQ-18.

Table S1. Environmental condition in the sites in Gansu, China.

Sites	**Latitude and longitude**	**Eleva-tion (m)**	**Mean Monthly Precipitation (mm)**			**Average monthly Temperature (℃)**			**Soil type**	**Vegetation type**
			July	September	December	July	September	December		
Anxi	40.75°N 95.75°E	1514	32.87	12.99	1.02	23.92	18.86	-6.98	entisols and aridisols	Desert shrub, subshrub
Minqin	38.75°N 103.25°E	1406	13.95	18.56	1.27	24.57	19.66	-4.02	entisols and aridisols	Desert shrub, subshrub

Table S2. DSE isolates from medicinal plant roots and results of sequence Blast from type material database.

	Strains	Taxonomic affiliation (accession numbers)	Similarity	Percent identify
1	HGQ-1	*Alternaria chlamydospore* (MW548074)	94%	100.00%
2	HGQ-2	*Alternaria* sp. (MW548075)	99%	100.00%
3	HGQ-3	*Preussia terricola* (MW548076)	98%	93.21%
4	HGQ-4	*Laburnicola* sp. (MW548077)	98%	95.07%
5	HGQ-5	*Alternaria tellustris* (MW548078)	100%	99.81%
6	HGQ-6	*Apiosordaria backusii* (MW548079)	93%	94.88%
7	HGQ-7	*Fusarium petersiae* (MW548080)	100%	98.83%
8	HGQ-8	*Microascus alveolaris* (MW548081)	94%	99.01%
9	HGQ-9	*Herpotrichia striatispora* (MW548082)	83%	96.69%
10	HGQ-10	*Fusarium* sp. (MW548083)	98%	98.40%
11	HGQ-12	*Emericellopsis maritima* (MW548085)	93%	99.20%
12	HGQ-14	*Alternaria chartarum* (MW548087)	94%	99.80%
13	HGQ-15	*Exserohilum pedicellatum* (MW548088)	99%	100.00%
14	HGQ-16	*Cyphellophora olivacea* (MW548089)	93%	99.81%
15	HGQ-17	*Enterocarpus grenotii* (MW548090)	100%	99.21%
16	HGQ-18	*Thermomyces verrucosus* (MW548091)	100%	99.62%
17	HGQ-19	*Slopeiomyces cylindrosporus* (MW548092)	98%	100.00%

Table S3. DSE species diversity of *L. ruthenicum.*

Season	Sites	Shannon-Wiener	Simpson	Pielou	IR%
July	Anxi	1.7623	0.7958	0.9057	17.00
	Minqin	1.2770	0.6939	0.9212	7.00
September	Anxi	1.4583	0.7456	0.9061	13.00
	Minqin	0.6365	0.4444	0.9183	3.00
December	Anxi	1.5171	0.7639	0.9426	12.00
	Minqin	1.0549	0.6400	0.9602	5.00

Table S4. Two-way analysis of variance of the effects in different months and sites on soil factors.

Item	Season		Sites		Season * Sites	
	F	*P*	F	*P*	F	*P*
pH	9.342	0.004	4.296	0.06	0.718	0.508
ALP	68.545	<0.001	8.709	0.012	4.16	0.042
Urease	48.624	<0.001	0.003	0.955	0.445	0.651
AP	18.906	<0.001	10.177	0.008	1.253	0.321
AN	4.4	0.037	13.379	0.003	9.46	0.003
SOC	0.442	0.653	36.827	<0.001	0.128	0.881
Temp	65.587	<0.001	0.094	0.765	1.335	0.3
SM	22.404	<0.001	136.343	<0.001	24.728	<0.001

ALP, alkaline phosphatase; AP, available phosphorus; AN, alkali-hydrolyzale nitrogen; SOC, soil organic carbon; Temp, Temperature; SM, soil moisture.

Table S5. Correlation relationship among DSE colonization and soil factors.

Item	Hyphae	Microsclerotia	Total colonization	Colonization intensity
pH	-0.377	0.562*	-0.328	-0.22
ALP	-0.548*	-0.108	-0.585*	-0.609**
Urease	-0.517*	-0.369	-0.551*	-0.658**
AP	-0.221	0.526*	-0.187	-0.247
AN	-0.097	-0.097	-0.322	-0.426
SOC	0.533*	0.208	0.35	0.281
Temp	-0.093	-0.672**	-0.164	-0.314
SC	0.081	-0.049	-0.1	-0.213

ALP, alkaline phosphatase; AP, available phosphorus; AN, alkali-hydrolyzale nitrogen; SOC, soil organic carbon; Temp, Temperature; SC: soil moisture. * indicate significant difference at $P < 0.05$; ** indicate significant difference at $P < 0.01$.