SUPPLEMENTARY MATERIAL

Table S1. Primers sequences, products sizes and annealing temperatures used in PCR assays for the identification of the different fungal genera associated with the marketed quinoa seed samples.

Locus	Primer	Sequences (5′ – 3′)	Product size (bp)	Annealing temp. (°C)	References
ACT	ACT-512F (Fw)	ATGTGCAAGGCCGGTTTCGC	300	61	41
	ACT-783R(Bw)	TACGAGTCCTTCTGGCCCAT			
BenA	Bt2a (Fw)	GGTAACCAAATCGGTGCTGCTTTC	550	55	42
	Bt2b (Bw)	ACCCTCAGTGTAGTGACCCTTGGC			
CaM	CMD5 (Fw)	CCGAGTACAAGGARGCCTTC	500	55	44
	CMD6 (Bw)	CCGATRGAGGTCATRACGTGG			
ITS	ITS1 (Fw)	TCCGTAGGTGAACCTGCGG	500	57	40
	ITS4 (Bw)	TCCTCCGCTTATTGATATGC			
RPB2	fRPB2- 5F (Fw)	GAYGAYMGWGATCAYTTYGG	1220	48-51	43
	fRPB2- 7cR(Bw)	CCCATRGCTTGYTTRCCCAT			
TEF1-α	EF1 (Fw)	ATGGGTAAGGA(A/G)GACAAGAC	700	53	36,38
	EF2 (Bw)	GGA(G/A)GTACCAGT(G/C)ATCATGTT			

Table S2. Cycling profiles used for the fungal genomic DNA amplification in the PCR assays.

Locus	1 step	35 steps*			1 step	References
	Initial denaturation	Denaturation	Annealing	Extension	Final extension	
ACT	95 °C x 4 min	94 °C x 45 s	60 °C x 40 s	72 °C x 1 min	72 °C x 10 min	41
BenA	95 °C x 4 min	94 °C x 1 min	67 °C x 1 min	72 °C x 1 min	72 °C x 10 min	45
CaM	95 °C x 4 min	95 °C x 1 min	55 °C x 1 min	72 ° C x 2 min	72 °C x 8 min	45
ITS	95 °C x 3 min	94 °C x 45 s	57 °C x 50 s	72 °C x 1 min	72 °C x 10 min	45
RPB2	95 °C x 5 min	95 °C x 1 min	47 °C x 1 min	72°C x 2 min	72 °C x 10 min	43
TEF1-α	94 °C x 5 min	94 °C x 60 s	53 °C x 1 min	72 °C x 1 min	72 °C x 10 min	36

*For *TEF1-α* gene amplification of *Fusarium* spp., 30 cycles of amplification were performed.

Table S3. *Alternaria* spp. isolates used in the phylogenetic analysis and related GenBank accession numbers.

Isolates[1]	Species	GenBank accession numbers	
		ITS	***RPB2***
CBS 534.83	*Alternaria abundans*	JN383485	KC584448
CBS 916.96[T]	*Alternaria alternata*	AF347031	KC584375
CBS 119396	*Alternaria alternarina*	KR425581	JQ905199
CBS 102605	*Alternaria arborescens*	NR135927	KC584377
CBS 210.86[T]	*Alternaria infectoria*	DQ323697	KC584404
CBS 115269	*Alternaria aspera*	KC584242	KC584474
AC90	*Alternaria atra*	LC440624	LC476833
CBS 200.67[T]	*Alternaria chartarum*	AF229488	KC584481
CBS 918.96	*Alternaria tenuissima*	AF347032	KC584435
Q 54	*Alternaria arborescens*	**OM892836**	**OM908530**
Q 113	*Alternaria alternata*	**OM892837**	**OM908531**
Q 132	*Alternaria abundans*	**OM892838**	**OM908532**
Q 149	*Alternaria infectoria*	**OM892839**	**OM908533**
Q 178	*Alternaria chartarum*	**OM892840**	**OM908534**
Q180	*Alternaria chartarum*	**OM892841**	**OM908535**
Q 184	*Alternaria alternata*	**OM892842**	**OM908536**
CBS 191.86[T]	*Stemphylum herbarum*	KC584239	KC584471

[1]CBS: Culture collection of the Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Utrecht, the Netherlands; Q: isolates obtained from the present study and deposited in the fungal culture collection of the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Perugia, Italy. Bold type, GenBank accession numbers of these isolates. T= Type strain.

Table S4. *Penicillium* spp. isolates used in the phylogenetic analysis and related GenBank accession numbers.

Isolates[1]	Species	GenBank accession numbers	
		RPB2	***ITS***
CBS 321.59	*Penicillium aeneum*	KP064573	KP016812
CBS 324.89	*Penicillium aurantiogriseum*	JN406573	JN942751
CBS 257.29	*Penicillium brevicompactum*	JN406594	KF465776
CBS 300.48	*Penicillium canescens*	JN121485	MH856353
F 727	*Penicillium cellarum*	KM249117	KM249068
CBS 126236	*Penicillium chrystenseniae*	JN606624	MH863992
CBS 306.48	*Penicillium chrysogenum*	JN121487	MH856357
CBS 321.59	*Penicillium citreonigrum*	KP064573	MH857876
CBS 139158	*Penicillium citreosulfuratum*	KP064678	JX140939
CBS 139162	*Penicillium citreosulfuratum*	KP 064679	JX140940
CBS 139.45	*Penicillium citrinum*	JF417416	MH856132
CBS 312.48	*Penicillium corylophilum*	KP064631	MH856360
CBS 115503	*Penicillium crustosum*	MN969114	MH862985
CBS 110412	*Penicillium dipodomyis*	JX996474	MH862862
CBS 325.48	*Penicillium expansum*	JF417427	AB479309
CBS 419.89	*Penicillium flavigenum*	JF909939	MH862182
CBS 101486	*Penicillium freii*	JN606624	JN942735
CBS 135.41	*Penicillium hirsutum*	JN406629	MH856088
CBS 221.28	*Penicillium jaczewskii*	JN406612	MH854991
CBS 161.81	*Penicillium murcianum*	MN969202	MN431400
5158	*Penicillium nordicum*	KJ527378	KJ527448
CBS 222.28	*Penicillium polonicum*	JN985417	JN942711
CBS 367.48	*Penicillium restrictum*	JN121506	MH856396
CBS 129667	*Penicillium rubens*	JX996658	JX997057
CBS 424.89	*Penicillium solitum*	KU904363	MH860945
PUMCH_Q141	*Penicillium toxicarium*	MW122813	MT940755
CBS 603.74	*Penicillium verrucosum*	JN121539	AB479317
CBS 390.48	*Penicillium viridicatum*	JN121511	FJ613113
Q 5	*Penicillium verrucosum*	**OM908537**	**OM892850**
Q 9	*Penicillium chrysogenum*	**OM908538**	**OM892851**
Q 35	*Penicillium toxicarium*	**OM908540**	**OM892853**
Q 39	*Penicillium dipodomyis*	**OM908541**	**OM892854**
Q 145	*Penicillium polonicum*	**OM908542**	**OM892855**
Q 181	*Penicillium chrysogenum*	**OM908543**	**OM892856**
CBS 310.38	*Talaromyces flavus*	JF417426	JN899360

[1]CBS: Culture collection of the Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Utrecht, the Netherlands; Q: isolates obtained from the present study and deposited in the fungal culture collection of the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Perugia, Italy. Bold type, GenBank accession numbers of these isolates.

Table S5. *Aspergillus* spp. isolates used in the phylogenetic analysis and related GenBank accession numbers.

Isolates[1]	Species	GenBank accession numbers	
		BenA	***CaM***
CBS 557.65 T	*Aspergillus awamori*	AY820001	AJ964874
CBS 101740 T	*Aspergillus brasiliensis*	AY820006	AM295175
CBS 111.26 T	*Aspergillus carbonarius*	AY585532	AJ964873
CBS 115574 T	*Aspergillus costaricaensis*	AY820014	EU163268
DTO 321_G4	*Aspergillus creber*	ON807807	ON807944
NRRL 227 T	*Aspergillus cvjetkovicii*	EF652264	EF652352
CBS 122712 T	*Aspergillus eucalypticola*	EU482435	EU482433
NRRL 302 T	*Aspergillus flavipes*	EU014085	EF669549
CBS 100927 T	*Aspergillus flavus*	EF661485	EF661508
CBS 133.61 T	*Aspergillus fumigatus*	EF669791	EF669860
NRRL 58600 T	*Aspergillus jensenii*	JN854007	JN854046
NRRL225	*Aspergillus jensenii*	JN854000	JN854020
UTHSC 09-425	*Aspergillus jensenii*	LN898858	LN898781
CBS 589.65 T	*Aspergillus nidulans*	EF652251	EF652339
CBS 554.65 T	*Aspergillus niger*	AY585536	AJ964872
CBS 115.27 T	*Aspergillus niveus*	EF669528	EF669573
CBS 108.08 T	*Aspergillus ochraceous*	EF661322	EF661381
CBS 100926 T	*Aspergillus parasiticus*	EF661481	EF661516
CBS 112811 T	*Aspergillus piperis*	AY20013	EU163267
CBS 756.74 T	*Aspergillus pseudoflectus*	EF652331	EF652419
CBS 593.65 T	*Aspergillus sydowii*	EF652274	EF652362
CBS 103.14T	*Aspergillus tamarii*	EF661474	EF661526
CBS 134.48 T	*Aspergillus tubingensis*	AY820007	AJ964876
CBS 113365 T	*Aspergillus vadensis*	AY585531	EU163269
CBS 139.54 T	*Aspergillus welwitschiae*	FJ629291	KC480196
Q 29	*Aspergillus jensenii*	**OM974258**	**OM974262**
Q 49	*Aspergillus fumigatus*	**OM974259**	**OM974263**
Q 73	*Aspergillus tubingensis*	**OM974260**	**OM974264**
Q 146	*Aspergillus flavus*	**OM974261**	**0M974265**
CBS 310.38 T	*Talaromyces flavus*	JX494302	KF741949

[1]CBS: Culture collection of the Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Utrecht, the Netherlands; NRRL: Mycological collection of the National Regional Research Laboratory, Peoria, IL, USA. Q: isolates obtained from the present study and deposited in the fungal culture collection of the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Perugia, Italy. Bold type, GenBank accession numbers of these isolates. T= Type strain.

Table S6. *Cladosporium* spp. isolates used in the phylogenetic analysis and related GenBank accession numbers.

Isolates[1]	Species	GenBank accession number	
		ITS	***ACT***
CBS 121624^T	*Cladosporium allicinum*	EF679350	EF679502
CBS 125984^T	*Cladosporium australiense*	HM147999	*HM148486*
CBS 112388^T	*Cladosporium cladosporioides*	HM148003	*HM148490*
CPC 10142	*Cladosporium cladosporioides*	HM148015	*HM148502*
CBS 143361	*Cladosporium. parasubtilissimum*	MF473170	MF474018
CBS 125993	*Cladosporium pseudocladosporioides*	HM148158	*HM148647*
CBS 139572	*Cladosporium uwebraunianum*	KP701873	KP701996
CBS 121621^T	*Cladopsorium herbarum*	EF679363	EF679516
Q 55	*Cladosporium cladosporioides*	**OM892843**	**OM906941**
Q 61	*Cladosporium allicinum*	**OM892844**	**OM906942**
Q 77	*Cladosporium. parasubtilissimum*	**OM892845**	**OM906943**
Q 92	*Cladosporium pseudocladosporioides*	**OM892846**	**OM906944**
Q 111	*Cladosporium uwebraunianum*	**OM892847**	**OM906945**
Q 131	*Cladosporium pseudocladosporioides*	**OM892848**	**OM906946**
Q 162	*Cladosporium cladosporioides*	**OM892849**	**OM906947**
CBS 116456	*Cercospora beticola*	NR121315	AY840458

[1]CBS: Culture collection of the Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Utrecht, the Netherlands; CPC: Culture collection of Pedro Crous, housed at CBC; Q: isolates obtained from the present study and deposited in the fungal culture collection of the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Perugia, Italy. Bold type, GenBank accession numbers of these isolates. T= Type strain.

Table S7. *Fusarium* spp. isolates used in the phylogenetic analysis and related GenBank accession numbers.

Isolates[1]	Phylogenetic species	Genbank accession numbers
		TEF1-α
CBS 485.94	*Fusarium acuminatum*	AB674279
MAFF 239206	*Fusarium avenaceum*	AB674293
NRRL 25084	FIESC 29-a	JF740715
NRRL 52758	FIESC 30-a	JF740833
CBS 144134	*Fusarium oxysporum*	MH485044
CBS 146.95	*Fusarium sambucinum*	KM231941
CBS 393.93	*Fusarium tricinctum*	AB674263
CBS 100312	*Fusarium verticillioides*	AB674288
Q 185	*Fusarium oxysporum*	**OM974256**
CBS 125552	*Geejayessia cicatricum*	HM626644
OR 74A	*Neurospora crassa*	XM959775

[1]CBS: Culture collection of the Centraalbureau voor Schimmelcultures, Fungal Biodiversity Centre, Utrecht, the Netherlands; MAFF: Central Bank of the microrganisms section in the Ministry of Agriculture, Forestry and Fisheries GeneBank in Tsukuba, Japan; NRRL: Mycological collection of the National Regional Research Laboratory, Peoria, IL, USA. Q: isolate obtained from the present study and deposited in the fungal culture collection of the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Perugia, Italy. Bold type, GenBank accession number of this isolate.

Table S8. *Alternaria*, *Aspergillus*, *Cladosporium*, *Fusarium* and *Penicillium* species reported in the literature at January 2023 on *Chenopodium quinoa*.

Fungal genus	Fungal species	Plant material	References
Alternaria	*Alternaria alternata*	root	48
		seed	52
	Alternaria infectoria	plant	50
Aspergillus	*Aspergillus flavus*	seed	18
	Aspergillius fumigatus	seed	18
	Aspergillus niger	seed	18
	Aspergillus oryzae	seed	18
	Aspergillu parasiticus	seed	18
	Aspergillus sidowii	seed	18
Penicilllium	*Penicillium aurantogriseum*	seed	18
	Penicilllium brevicompactum	seed, root	18,48
	Penicilllium canescens	seed	18
	Penicillium chrysogenum	seed	18
	Penicillium citrinum	seed	18
	Penicilllium commune	seed	18
	Penicilllium corylophilum	seed	18
	Penicillium crustosum	seed	18
	Penicillium griseofulvum	seed	18
	Penicillium hirsutum	seed	18
	Penicilllium jaczewskii	seed	18
	Penicillium murcianum	root	48
	Penicillium minioletum	root	48
	Penicilllium polonicum	seed	18
	Penicilllium solitum	seed	18
	Penicilllium viridicatum	seed	18
Fusarium	*Fusarium acuminatum*	plant	49
	Fusarium avenaceum	plant	49
	Fusarium brachygibbosum	seed	55
	Fusarium citri	seed	52
	Fusarium culmorum	plant	53
	Fusarium equiseti	seed	51
		plant	53
	Fusarium graminearum	plant	53
	Fusarium oxysporum	root	48
		plant	53
	Fusarium sambucinum	root	48
	Fiusaurium tricinctum	root	48
Cladosporium	*Cladosporium spp.*	seed	19,18
	Cladopsorium cladosporioides	panicle	54

Table S9. Average numbers of the fungal colonies of each genus or as total of the isolated fungi obtained from the 25 marked-bought quinoa seed samples.

Samp	Metho	Total fungal gene	*Alternaria*	*Cladosporium*	*Penicillium*	*Fusarium*	*Aspergillus*	*Others fungal gener*
1	TOTAL	0,5 ± 0,186 abc	0 ± 1,46e-06 a	0,10 ± 5,96e-02 ab	0,10 ± 5,23e-02 ab	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,05 ± 3,40e-02 ab
1	PDA	0,1 ± 0,098 a B	0 ± 4,50e-06 a B	0 ± 4,81e-06 a B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,1 ± 0,0715 a A
1	DFB	0,9 ± 0,295 abc A	0,5 ± 1,33e-01 abc A	0,2 ± 9,09e-02 abc A	0,2 ± 0,0804 ab A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
2	TOTAL	0,25 ± 0,131 a	0 ± 1,46e-06 a	0,15 ± 7,30e-02 ab	0,05 ± 3,70e-02 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0 ± 3,60e-06 a
2	PDA	0,1 ± 0,098 a A	0 ± 4,50e-06 a A	0,3 ± 4,81e-06 a A	0,1 ± 0,0804 ab A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
2	DFB	0,4 ± 0,197 ab A	0,1 ± 5,95e-02 ad A	0 ± 4,81e-06 a B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
3	TOTAL	0,4 ± 0,167 ab	0 ± 1,46e-06 a	0,10 ± 5,96e-06 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0 ± 3,60e-06 a
3	PDA	0,2 ± 0,139 a A	0,2 ± 8,41e-02 abd A	0 ± 4,81e-06 a B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
3	DFB	0,6 ± 0,241 ab A	0,4 ± 1,19e-01 abcd A	0,2 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
4	TOTAL	1,8 ± 0,354 bcde	0 ± 1,46e-06 a	0 ± 7,35e-06 a	1,40 ± 1.96e-01 c	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,4 ± 9,62e-02 bc
4	PDA	0,6 ± 0,241 ab B	0 ± 4,50e-06 a A	0 ± 4,81e-06 a A	0,3 ± 0,0804 abc B	0 ± 0,0333 a A	0 ± 0,0648 a A	0,3 ± 0,0715 a B
4	DFB	3 ± 0,539 cde A	0 ± 4,50e-06 d A	0 ± 4,81e-06 a A	2,5 ± 0,0804 c A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,5 ± 0,0715 b A
5	TOTAL	1,95 ± 0,368 cde	1,55 ± 1,20e-01 b	0,05 ± 4,21e-02 ab	0,00 ± 3,91e-02 a	1,55± 1,26e-01 b	0,2 ± 6,37e-02 ab	0 ± 3,60e-06 a
5	PDA	0,5 ± 0, 220 ab B	0 ± 4,50e-06 a B	0,1 ± 6,43e-02 a A	0 ± 0,0804 a A	0 ± 0,0333 a B	0,4 ± 0,0648 b B	0 ± 0,0715 a A
5	DFB	3,4 ± 0,573 de A	0,3 ± 1,03e-01 abcd A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	3,1 ± 0,0333 b A	0 ± 0,0648 a A	0 ± 0,0715 a A
6	TOTAL	2,6 ± 0,425 d	1,40 ± 1,20e-01 b	0,40 ± 1,19e-01 ab	0,05 ± 3,70e-02 a	1,40± 1,20e-01 b	0,05 ± 3,19e-02 ab	0,55 ± 1,13e-01 c
6	PDA	0,3 ± 0,170 a B	0 ± 4,50e-06 a B	0,2 ± 9,09e-02 ab B	0,1 ± 0,0804 ab A	0 ± 0,0333 a B	0 ± 0,0648 a A	0 ± 0,0715 a B
6	DFB	4,9 ± 0,689 de A	0,3 ± 1,03e-01 abcd A	0,6 ± 1,57e-01 bc A	0 ± 0,0804 a A	2,8 ± 0,0333 c A	0,1 ± 0,0648 a A	1,1 ± 0,0715 c A
7	TOTAL	0,5 ± 0,186 abc	0 ± 1,46e-06 a	0,15 ± 7,30e-02 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0,2 ± 6,37e-02 ab	0 ± 3,60e-06 a
7	PDA	0,6 ± 0,241 ab A	0 ± 4,50e-06 a B	0,2 ± 9,09e-02 ab A	0 ± 0,0804 a A	0 ± 0,0333 a A	0,4 ± 0,0648 b B	0 ± 0,0715 a A
7	DFB	0,4 ± 0,197 ab A	0,3 ± 1,03e-01 abcd A	0,1 ± 6,43e-02 ab A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
8	TOTAL	0,95 ± 0,257 abcde	0 ± 1,46e-06 a	0,30 ± 1,03e-01 ab	0,20 ± 7,39e-02 ab	0 ± 1,46e-06 a	0,10 ± 4,51e-02 ab	0,15 ± 5,89e-02 abc
8	PDA	1,2 ± 0,341 ab A	0,1 ± 5,95e-02 ab A	0,5 ± 1,44e-01 abc B	0,4 ± 0,0804 abc B	0 ± 0,0333 a A	0,2 ± 0,0648 ab B	0 ± 0,0715 a B
8	DFB	0,7 ± 0,260 ab A	0,3 ± 1,03e-01 abcd A	0,1 ± 6,43e-02 ab A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,3 ± 0,0715 ab A
9	TOTAL	0,3 ± 0,144 a	0 ± 1,46e-06 a	0 ± 7,35e-06 a	0,10 ± 5,23e-02 ab	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,20 ± 6,80e-02 abc
9	PDA	0,6 ± 0,241 03 ab B	0 ± 4,50e-06 a A	0 ± 4,81e-06 a A	0,2 ± 0,0804 bc A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,4 ± 0,0715 a B
9	DFB	0 ± 0,001 a A	0 ± 4,50e-06 d A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
10	TOTAL	1,75 ± 0,349 bcde	0 ± 1,46e-06 a	0,35 ± 1,11e-06 ab	0,15 ± 6,40e-02 ab	0 ± 1,46e-06 a	0,2 ± 6,37e-02 ab	0,25 ± 7,60e-02 abc
10	PDA	0,4 ± 0,197 ab B	0 ± 4,50e-06 a B	0, 7 ± 1,70e-01 bc A	0,1 ± 0,0804ab A	0 ± 0,0333 a A	0,3 ± 0,0648 ab B	0 ± 0,0715 a B
10	DFB	3,1 ± 0,548 cde A	1,6 ± 2,38e-01 ef A	0 ± 4,81e-06 a B	0,2 ± 0,0804 ab A	0 ± 0,0333 a A	0,1 ± 0,0648 a A	0,5 ± 0,0715 b A
11	TOTAL	0,25 ± 0,132 a	0 ± 4,50e-06 a	0,10 ± 5,96e-02 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0,05 ± 3,19e-02 ab	0,10 ± 4,81e-02 ab
11	PDA	0 ± 0,001 a B	0 ± 4,50e-06 a A	0 ± 4,81e-06 a B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a B
11	DFB	0,5 ± 0,220 ab A	0 ± 4,50e-06 d A	0,2 ± 9,09e-02 abc A	0 ± 0,0804 a A	0 ± 0,0333 a A	0,1 ± 0,0648 a A	0,2 ± 0,0715 ab A
12	TOTAL	0,4 ± 0,167 ab	0 ± 1,46e-06 a	0,05 ± 4,21e-02 ab	0,05 ± 3,70e-02 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0 ±3,60e-06 a
12	PDA	0,1 ± 0,098 a B	0 ± 4,50e-06 a B	0 ± 4,81e-06 a A	0,1 ± 0,0804 ab A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
12	DFB	0,7 ± 0,260 ab A	0,6 ± 1,460e-01 abce A	0,1 ± 6,43e-02 ab A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
13	TOTAL	0,95 ± 0,257 abcde	0 ± 1,46e-06 a	0,05 ± 4,21e-02 ab	0,55 ± 1,23e-01 b	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,15 ± 5,89e-02 abc
13	PDA	0,7 ± 0, 260 ab A	0,1 ± 5,95e-02 ab A	0 ± 4,81e-06 a A	0,6 ± 0,0804 c A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a B
13	DFB	1,2 ± 0, 341 abce A	0,3 ± 1,03e-01 abcd A	0,1 ± 6,43e-02 ab A	0,5 ± 0,0804 bd A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,3 ± 0,0715 ab A
14	TOTAL	0,4 ± 0,167 ab	0 ± 1,46e-06 a	0,20 ± 8,43e-02 ab	0,05 ± 3,70e-02 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,05 ± 3,40e-02 ab
14	PDA	0,2 ± 0,139 a A	0 ± 4,50e-06 a B	0,1 ± 6,43e-02 a A	0,1 ± 0,0804 ab A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
14	DFB	0,6 ± 0,241 ab A	0,2 ± 8,41e-02 abd A	0,3 ± 1,11e-01 abc A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,1 ± 0,0715 a A
15	TOTAL	0,85 ± 0243 abcde	0,05 ± 2,27e-02 a	0,50 ± 1,33e-01 b	0,10 ± 5,23e-02 ab	0,05± 2,27e-02 a	0,05 ± 3,19e-02 ab	0,05 ± 3,40e-02 ab
15	PDA	0,2 ± 0, 139 a B	0 ± 4,50e-06 a B	0 ± 4,81e-06 a B	0,2 ± 0,0804 abc A	0 ± 0,0333 a B	0 ± 0,0648 a A	0 ± 0,0715 a A
15	DFB	1,5 ± 0,381 bce A	0,2 ± 8,41e-02 abd A	1,0 ± 2,03e-01 c A	0 ± 0,0804 a A	0,1 ± 0,0333 a A	0,1 ± 0,0648 a A	0,1 ± 0,0715 a A
16	TOTAL	0,75 ± 0,228 abce	0 ± 1,46e-06 a	0 ± 7,35e-06 a	0,35± 9,78e-02 ab	0 ± 1,46e-06 a	0,3 ± 7,81e-02 b	0 ± 3,60e-06 a
16	PDA	0,6 ± 0,241 ab A	0,1 ± 5,95e-02 ab A	0 ± 4,81e-06 a A	0 ± 0,0804 a B	0 ± 0,0333 a A	0,5 ± 0,0648 b B	0 ± 0,0715 a A
16	DFB	0,9 ± 0,295 abc A	0,1± 5,95e-02 ad A	0 ± 4,81e-06 a A	0,7 ± 0,0804 d A	0 ± 0,0333 a A	0,1 ± 0,0648 a A	0 ± 0,0715 a A
17	TOTAL	2,1 ± 0,382 de	0 ± 1,46e-06 a	0,50 ± 1,33e-01 b	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,10 ± 4,81e-02 ab
17	PDA	1 ± 0,311 ab B	0 ± 4,50e-06 a B	1,0 ± 2,03e-01 bc B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a B
17	DFB	3,2 ± 0, 557 cde A	3,0± 3,26e-01 f A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,2 ± 0,0715 ab A
18	TOTAL	0,6 ± 0,204 abce	0 ± 1,46e-06 a	0,15 ± 7,30e-02 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0 ± 3,60e-06 a
18	PDA	0,1 ± 0,098 a B	0 ± 4,50e-06 a B	0,1 ± 6,43e-02 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
18	DFB	1,1 ± 0,326 abce A	0,9 ± 1,79e-01 bce A	0,2 ± 9,09e-02 abc A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
19	TOTAL	0,6 ± 0,204 abce	0 ± 1,46e-06 a	0,20 ± 8,43e-02 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0,10 ± 4,81e-02 ab
19	PDA	0 ± 0,001 a B	0 ± 4,50e-06 a B	0 ± 4,81e-06 a B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
19	DFB	1,2 ± 0,340 abce A	0,6 ± 1,460e-01 abce A	0,4 ± 1,29e-01 abc A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,2 ± 0,0715 ab B
20	TOTAL	1,2 ± 0,289 abcde	0 ± 1,46e-06 a	0,60 ± 1,46e-01 b	0,2 ± 7,39e-02 ab	0 ± 1,46e-06 a	0,10 ± 4,51e-02 ab	0 ± 3,60e-06 a
20	PDA	2,1 ± 0,451 b B	0,2 ± 8,41e-02 ab A	1,1 ± 2,13e-01 c B	0,4 ± 0,0804 abc B	0,2 ± 0,0333 b B	0,2 ± 0,0648 ab B	0 ± 0,0715 a A
20	DFB	0,3 ± 0,170 ab A	0,2 ± 8,41e-02 abd A	0,1 ± 6,43e-02 ab A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
21	TOTAL	0,2 ± 0,118 a	0 ± 1,46e-06 a	0,15 ± 7,30e-02 ab	0,05 ± 3,70e-02 a	0,1± 3,21e-02 a	0 ± 2,05e-06 a	0 ± 3,60e-06 a
21	PDA	0,3 ± 0, 170 a A	0 ± 4,50e-06 a A	0,3 ± 1,11e-01 abc B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
21	DFB	0,1 ± 0,984 ab A	0 ± 4,50e-06 d A	0 ± 4,81e-06 a A	0,1 ± 0,0804 ab A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
22	TOTAL	0,1 ± 0,083 a	0 ± 1,46e-06 a	0,10 ± 5,96e-02 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0 ± 3,60e-06 a
22	PDA	0,2 ±0,139 a A	0 ± 4,50e-06 a A	0,2 ± 9,09e-02 ab B	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
22	DFB	0 ± 0,001 a A	0 ± 4,50e-06 d A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
23	TOTAL	0,45 ± 0,177 ab	0 ± 1,46e-06 a	0,05 ± 4,21e-02 ab	0,05 ± 3,70e-02 a	0 ± 1,46e-06 a	0,05 ± 3,19e-02 ab	0,05 ± 3,40e-02 ab
23	PDA	0,2 ± 0,139 a A	0 ± 4,50e-06 a B	0,1 ± 6,43e-02 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0,1 ± 0,0715 a A
23	DFB	0,7 ± 0,260 ab A	0,5 ± 1,33e-01 abc A	0 ± 4,81e-06 a A	0,1 ± 0,0804 ab A	0 ± 0,0333 a A	0,1 ± 0,0648 a A	0 ± 0,0715 a A
24	TOTAL	0,1 ± 0,084 a	0 ± 1,46e-06 a	0 ± 7,35e-06 a	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0,05 ± 3,19e-02 ab	0 ± 3,60e-06 a
24	PDA	0 ± 0,001 a A	0 ± 4,50e-06 a A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
24	DFB	0,2 ± 0,139 ab A	0,1± 5,95e-02 ad A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0,1 ± 0,0648 a A	0 ± 0,0715 a A
25	TOTAL	0,95 ± 0,257 abcde	0 ± 1,46e-06 a	0,05 ± 4,21e-02 ab	0 ± 3,91e-06 a	0 ± 1,46e-06 a	0 ± 2,05e-06 a	0 ± 3,60e-06 a
25	PDA	0,8 ± 0,278 ab A	0,7 ± 1,57e-01 b A	0,1 ± 6,43e-02 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A
25	DFB	1,1 ± 0,326 abce A	1,1± 1,97e-01 ce A	0 ± 4,81e-06 a A	0 ± 0,0804 a A	0 ± 0,0333 a A	0 ± 0,0648 a A	0 ± 0,0715 a A

Average numbers of fungal colonies obtained in total (TOTAL) or either by isolation on Potato Dextrose Agar (PDA) or deep-freezing blotter test (DFB) from each market-bought quinoa seed sample as identified by morphological features. For each sample, the TOTAL column represents the average (± SE) of the 20 analyzed plates, each containing 10 seeds, for a total of 200 seeds, PDA and DFB columns represent the average (± SE) of 10 analyzed plates, each containing 10 seeds, for a total of 100 seeds per method. In each column, lowercase letters indicate significant differences (p= 0.05, Tuckey's multiple range test) between samples inside each class (TOTAL, PDA or DFB) and uppercase letters indicate significant differences (p= 0.05, Tuckey's multiple range test) between the two different isolation methods (PDA or DFB) inside each seed sample.

Table S10. Results of BLAST analysis.

Genus	Isolates	Species resulting from the *BLAST* analysis of the amplified regions	
		ITS	*RPB2*
Alternaria	Q 54	***A. alstroemeriae, A. alternata, A. tenuissima, A. burnsii, A. brassicicola, A. brassicae, A. gaisen, A. arborescens, A. longipes.***	***A. arborescens***, *A. alternata, A. postmessia, A. tenuissima, A. burnsii, A. yaliinficiens, A. citricancri, A. longipes, A. tectorum, A. setosae, A. daucifolii, A. iridicola, A. maritima, A. gaisen.*
	Q 113	***A. alternata, A. angustiovoidea, A. tenuissima, A. compacta, A. brassicae, A. solani, A. alstroemeriae.***	***A. alternata, A. postmessia***, *A. tenuissima, A. arborescens, A. tectorum.*
	Q 132	***A. abundans***, *A. pobletensis, A. infectoria, A. maloroum, A. rosae.*	***A. abundans***, *A. armoraciae, A. breviramosa, A. hordeiaustralica, A. dactylidicola, A. incomplexa, A. metachromatica, A. arbusti, A. novae-zelandiae, A. viburni, A. conjuncta, A. triticimaculans, A. infectoria, A. rosae, A. kulundi, A. ventricosa, A. papavericola, A. solani, A. cetera, A. arbusti, A. citricancri.*
	Q 149	***A. infectoria, A. cerasidanica, A. conjuncta, A. hordeicola, A. murispora***, *A. japonica, A. hordeiaustralica, A. ventricosa.*	***A. infectoriae, A. alternarina***, *A. hordeicola, A. californica, A. humuli, A. hampshirensis, A. infectoria, A. slovaca, A. triticimaculans.*
	Q 178	***A. chartarum, A. alternata***, *A. aspera, A. brassicaeporri, A. multiformis, A. consortialis, A. terricola.*	***A. atra***, *A. arborescens, A. postmessia, A. solani, A. alternata, A. metachromatica, A. rosae, A. vaccariae, A. japonica, A. papavericola, A. ethzedia, A. incomplexa, A. arbusti, A. infectoriae, A. ventricosa, A. conjuncta, A. tenuissima, A. horediaustralica, A. viburni, A. zinniae, A. concatenata, A. solani, A. yaliinficiens, A. longipes, A. novae-zelandiae, A. aspera, A. blumeae, A. calendulae.*
	Q180	***A. aspera, A. alternata, A. chartarum***, *A. brassicae, A. alternata, A. sorghi, A. consortialis, A. terricola, A cantlous, A. brassicae, A. multiformis.*	***A. atra***, *A. arborescens, A. alternata, A. postmessia, A. solani, A. burnsii, A. rosae, A. vaccariae, A. papavericola, A. japonica, A. metachromatica, A. incomplexa, A. ethzedia, A. arbusti, A. infectoria, A. ventricosa, A. citricancri, A. zinniae.*
	Q 184	***A. alternata, A. angustiovoidea, A. tenuissima, A. compacta, A. brassicae, A. solani***.	***A. alternata, A. tenuissima, A. postmessia***, *A. tectorum, A. longipes, A. yaliinficiens, A. citricancri.*
Penicillium	Q 5	***P. verrucosum***, *P. allii, P. albocoremium, P. viridicatum, P. hordei, P. nordicum, P. thomii, P. noeochinulatum, P. christenseniae, P. poloniucm, P. solitum, P. aurantiogriseum, P. hirsutum, P. cordubense, P. lapidosum.*	***P. nordicum***, *P. thymicola, P. freii, P. solitum, P. venetum, P. verrucosum, P. sublectaticum, P. polonicum, P. speluncae, P. aurantiogriseum, P. echinulatum, P. discolor, P. melanoconidium, P. crustosum, P. viridicatum, P. commune, P. cavernicola, P. noeoechinulatum.*
	Q 9	***P. chrysogenum, P. crustosum, P. griseofulvum, P. rubens, P. aetiophicum, P. commune, P. allii-sativi, P. fimorum.***	***P. chrysogenum***, *P. glycyrrhizacola, P. rubens, P. vanluyki, P. alii-sativi.*
	Q 35	***P. aeneum, P. citreonigrum, P. citreosulfuratum, P. toxicarium, P. fundyense.***	***P. citreonigrum***, *P. fundyense, P. toxicarium, P. citreoviride, P. citreosulfuratum, P. restrictum.*
	Q 39	***P. dipodomys, P. chrysogenum, P. griseofulvum, P. granulatum***, *P. lanosum, P. flavigenum, P. nalgiovense, P. vinaceum, P. commune.*	***P. dipodomys***, *P. nalgiovense, P. glycirrhizicola, P. chrysogenum, P. flavigenum, P. confertum, P. expansum.*
	Q 145	***P. polonicum***, *P. aurantiogriseum, P. cellarum, P. freii, P. christenseniae, P. viridicatum, P. neoechinolatum, P. melanoconidium, P. cyclopium, P. camemberti, P.sublectaticum, P. mali-pumilae, P. tricolor, P. speluncae, P. venetum, P. radicicola, P. commune, P. caseifulfum, P. tulipae, P. camemberti, P. echinolatum, P. allii, P. biforme, P. discolor, P. thymicolae, P. solitum, P. psychrotrophicum.*	***P. polonicum***, *P. aurantiogriseum, P. cellarum, P. freii, P. christenseniae, P. viridicatum, P. neoechinulatum, P. melanoconidum, P. cyclopium, P. sublectaticum, P. mali-pumilae.*
	Q 181	***P. olsonii, P. granulatum, P. chrysogenum, P. camemberti, P. allii-sativi, P. griseofulvum, P. flavigenum, P. crustosum, P. rubens, P. aethiopicum.***	***P. chrysogenum,*** *P. rubens, P. glycyrrhizacola.*
Genus	**Isolates**	**Species resulting from the BLAST analysis of the amplified regions**	
		ITS	***ACT***
Cladosporium	Q 55	***C. pseudocladosporioides, C. westerdijkiae, C. cladosporioides, C. asperulatum, C. perangustum, C. allicinum, C. uwebraunianum, C. delicatulum, C. inversicolor, C.subuliforme, C. tenuissima, C. oryzae, C. montecillanum, C. phyllophilum, C. europaeum.***	***C. cladosporioides***, *C. anthropophilum.*
	Q 61	***C. allicinum, C. herbarum, C. ramotenellum, C. iridiscucumerinum***	***C. allicinum, C.*** *bruhnei.*

	Q 77	***C. allicinum, C. herbarum, C. parasubtilissimum, C. iridis, C. floccosum, C. sinuosum, C. macrocarpum.***	***C. parasubtilissimum****, C. allicinum, C. herbarum, C. subtilissimum, C. bruhnei, C. antarcticum, C. versiforme.*
	Q 92	***C. pseudocladosporioides, C. cladosporioides, C. funiculosum, C. perangustum, C. rectoides, C. uwebraunianum, C. inversicolor, C. subuliforme, C. tenuissimum, C. westerdijkiae, C. phyllophilum, C. delicatulum.***	***C. pseudocladosporioides****, C. cladosporioides, C. funiculosum, C. halotolerans.*
	Q 111	***C. pseudocladopsorioides, C. cladosporioides, C. funiculosum, C. perangustum, C. rectoides, C. westerdijkiae, C. asperulatum, C. allicinum, C. uwebraunianum, C. delicatulum, C. inversicolor, C. subuliforme, C. tenuissimum, C. phyllophilum, C. europaeum.***	***C. uwebraunianum, C. pseudocladopsorioides,*** *C. australiense, C. angustisporum, C. phaenocomae, C. gamsianum, C. needhamense.*
	Q 131	***C. pseudocladopsorioides, C. cladosporioides, C. westerdijkiae, C. asperulatum, C. perangustum, C. allicinum, C. uwebraunianum, C. delicatulum, C. inversicolor, C. subuliforme, C. tenuissimum, C. montecillanum, C. europaeum.***	***C. pseudocladosporioides****, C. cladosporioides, C. funiculosum, C. halotolerans, C. endoviticola.*
Cladosporium	Q 162	***C. pseudocladosporioides, C. cladosporioides, C. funiculosum, C. perangustum, C. rectoides, C. westerdijkiae, C. asperulatum, C. allicinum, C. uwebraunianum, C. delicatulum, C. inversicolor, C. tenuissimum, C. oryzae, C. phyllophilum.***	***C. cladosporioides****, C. anthropophilum.*
Genus	**Isolates**	**Species resulting from the BLAST analysis of the amplified regions**	
		BenA	***CaM***
Aspergillus	Q 29	***A. jensenii, A. creber,*** *A. cvjetkovicii*	***A. jensenii, A. creber, A. cvjetkovicii.***
	Q 49	***A. fumigatus***	***A. fumigatus***
	Q 73	***A. tubingensis***	***A. tubingensis, A. niger, A. phoenicis***
	Q 146	***A. flavus***	***A. flavus***
Genus	**Isolates**	**Species resulting from the BLAST analysis of the amplified regions**	
		TEF1-a	
Fusarium	Q 185	***F. oxysporum***	

Bold type: species that gave the maximum similarity with the blasted sequence. **Gray highlighter**: species confirmed by the subsequent phylogenetic analysis

Table S11. Secondary metabolites detected in the freeze-dried culture of the isolates Q 146 of *Aspergillus flavus* obtained from marketed quinoa (*Chenopodium quinoa* Willd.) seed samples and grown on Czapek Yeast Autolysate (CYA) Agar medium.

Aspergillus **secondary metabolites**	**μg Kg^{-1}**
Aflatoxins	
Aflatoxicol	551
Aflatoxin B1	64200
Aflatoxin B2	4860
Aflatoxin M1	1500
Aflatoxin P1	114
O-Methyl sterigmatocystin	367
Methoxysterigmatocystin	1
Sterigmatocystin	35.3
Anthraquinoids	
Averantin	435
Averufin	520
Norsolorinic acid	143
Dihydrobenzofuran derivative	
Asperfuran	632
Diketopiperazines	
Brevianimide F	9170
Cyclo (L-Pro_L-Tyr)	41700
Cyclo (L-Pro_L-Val)	19700
Koningic acid	
Heptelidic acid	202000
Propionic acids	
3-Nitropropionic acid	1970000
Pyrones	
Kojic acid	92800
Sesquiterpenes	
Sporogea AO	7130
Versicolorin	
Versicolorin A	262
Versicolorin C	919
Versiconal Acetate	51.6
Versiconol	4020