

Supplementary Tables

Table S1. Details of oligonucleotide primers used in this study.

Primer	Primer sequence (5'-3')	Sense	Target	References
P1	AGA-GTT-TGA-TCC-TGG-CTC-AGG-A	Forward	16S rDNA	[1]
P7	CGT-CCT-TCA-TCG-GCT-CTT	Reverse	23S rDNA	[1]
P1A	AAC-GCT-GGC-GGC-GCG-CCT-AAT-AC	Forward	16S rDNA	[2]
P7A	CCT-TCA-TCG-GCT-CTT-AGT-GC	Reverse	23S rDNA	[2]
fB1	GAC-CCT-TCA-AAA-GGT-CTT-AG	Forward	16S rDNA	[3]
rULWS	GTC-TTT-TAT-ATA-AGA-GAA-ACA-C	Reverse	16S/23S rDNA spacer region	[3]
R16(V)F1	TTA-AAA-GAC-CTT-CTT-CGG	Forward		[4]
R16(V)R1	TTC-AAT-CCG-TAC-TGA-GAC-TAC-C	Reverse	16S rDNA	[4]
rp(V)F1	TCG-CGG-TCA-TGC-AAA-AGG-CG	Forward	<i>rpsS</i>	[2]
rp(V)R1	ACG-ATA-TTT-AGT-TCT-TTT-TGG	Reverse	<i>rplP</i>	[2]
rp(V)F1A	AGG-CGA-TAA-AAA-AGT-TTC-AAA-A	Forward	<i>rpsS</i>	[2]
rp(V)R1A	GGC-ATT-AAC-ATA-ATA-TAT-TAT-G	Reverse	<i>rplP</i>	[2]
FD9f5	CAA-AAA-ATT-ACT-TTT-GGC-GGG-AC	Forward	<i>SecY</i>	[5]
MAPr1	TGC-TCA-AAA-TGA-GCG-CTT-AAA-C	Reverse	<i>map</i>	[5]
FD9f6	GTC-GCT-TTA-GAA-TCG-ACA-CA	Forward	<i>SecY</i>	[5]
MAPr2	TCG-GAA-GTA-ACA-GCA-GTC-CA	Reverse	<i>map</i>	[5]
fEY_imp	CAT-TTT-AAA-TAC-TGT-ATA-TTA-AAT-AC	Forward	<i>imp</i>	[6]
rpYrG	GAC-CTT-TTA-AAC-CAC-ATC-C	Reverse	<i>imp</i>	[6]
fEY_groEL	GTT-AAT-GAT-GGC-GTT-ACA-ATC-GC	Forward	<i>groEL</i>	[6]
rEY_groEL	GTT-AAA-GAA-GGA-CTT-TTA-TCC-GC	Reverse	<i>groEL</i>	[6]

Table S2. Phytoplasmas related to the newly detected elm yellows (EY) phytoplasma strains in southern Italy examined in this study.

Phytoplasma (strain)	Geographical origin	Sequence*	GenBank accession No.	Reference/collector(s)
Elm yellows (EY1)-Ca.P.ulmi	USA	16S	AY197655	[2]
Elm yellows (EY1)	USA	16S, SR	AF122910	[7]
Elm yellows (WVEY)	USA	16S, SR	AF122911	[7]
Elm yellows (EY1)	USA	16S, SR	AF189214	[8]
Elm yellows (ULW)	France	16S	X68376	[9]
Elm yellows (EY626)	Italy	16S	AY197657	[2]
Elm yellows (EY627)	Italy	16S	AY197658	[2]
Elm yellows (EY125)	Italy	16S	AY197656	[2]
Elm yellows (EYCZ1)	Czech Republic	16S, SR	EU184021	[10]
Elm yellows (EY4PL)	Poland	16S, SR	MT859113	[Zwolinska A., Jurga M.]
Elm yellows (G1)	Korea	16S, SR	MW563863	[11]
Elm yellows (2625)	Germany	SR	MN394841	[12]
Elm yellows (4621)	Germany	SR	MN394842	[12]
Elm yellows (EY24-SRB)	Serbia	16S	HM038460	[13]
Elm yellows (EY1-SRB)	Serbia	16S	HM038455	[13]
Elm yellows (EY18-SRB)	Serbia	16S	HM038458	[13]
Elm yellows (EY10-SRB)	Serbia	16S	HM038457	[13]
Elm yellows (EY10-SRB)	Serbia	16S	HM038459	[13]
Elm yellows (EY6-SRB)	Serbia	16S	HM038456	[13]
Alder yellows (ALY-SI)	Italy	16S, SR	Y16387	[14]
Alder yellows (ALY)	Italy	16S	AY197646	[2]
Alder yellows (ALY882)	Germany	16S	AY197642	[2]
Alder yellows (AldWB)	Poland	16S, SR	MK440303	[15]
Spartium witches'-broom (SpaWB229)	Italy	16S	AY197652	[2]
Spartium witches'-broom (SpaWB229)	Italy	SR	Unpublished	[Marcone, C.]
Hemp dogbane yellows (HD1)	USA	16S	AY197654	[2]
Virginia creeper (VC)	USA	16S, SR	AF305198	[2]
Flavescence dorée (FD-C)	Italy	16S	AY197645	[2]
Flavescence dorée (FD-D)	Italy	16S	AY197644	[2]
Flavescence dorée (FD70)	France	16S, SR	AF176319	[8]
Flavescence dorée (34c2)	Croatia	16S, SR	HQ712064	[16]
Flavescence dorée (CH)	Switzerland	16S, SR	CP097583	[17]
Flavescence dorée (FD1487)	Spain	16S, SR	AJ548787	[18]
Japanese raisin witches'-broom (JRWB)	South Korea	16S, SR	AB442218	[19]
Peach yellows (PY-In)	India	16S	AY197660	[2]
Cherry lethal yellows (CLY-5)	India	16S	AY197659	[2]
Rubus stunt (RUS)-Ca.P.rubi	Italy	16S	AY197648	[2]
Jujube witches'-broom (JWB-G1)-Ca.P.ziziphi	China	16S	AB052876	[20]
Balanites witches'-broom (BltWB)-Ca.P.balanitae	Myanmar	16S, SR	AB689678	[21]
Elm yellows (EY1)	USA	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197675	[2]
Elm yellows (EY125)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197676	[2]
Elm yellows (EY626)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197677	[2]
Elm yellows (EY627)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197678	[2]
Elm yellows (NK16)	Croatia	<i>rpsV (rpl22), rpsC (rps3)</i>	KU202026	[22]
Elm yellows (KP7)	Croatia	<i>rpsV (rpl22), rpsC (rps3)</i>	KU202008	[22]
Elm yellows (DM1)	Croatia	<i>rpsV (rpl22), rpsC (rps3)</i>	KU201977	[22]
Elm yellows (EY20-SRB)	Serbia	<i>rpsV (rpl22), rpsC (rps3)</i>	HM038463	[13]
Elm yellows (EY24-SRB)	Serbia	<i>rpsV (rpl22), rpsC (rps3)</i>	HM038464	[13]
Elm yellows (EYCZ1)	Czech Republic	<i>rpsV (rpl22), rpsC (rps3)</i>	EU116428	[10]
Elm yellows (W4.4)	Poland	<i>rpsV (rpl22), rpsC (rps3)</i>	MT080945	[23]
Elm yellows (EY1-SRB)	Serbia	<i>rpsV (rpl22), rpsC (rps3)</i>	EU592500	[24]
Alder yellows (ALY)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197666	[2]
Alder yellows (ALY882)	Germany	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197662	[2]
Alder yellows (ALY1068)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197667	[2]
Flavescence dorée (FD-D)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197664	[2]
Flavescence dorée (FD-C)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197665	[2]
Rubus stunt (RUS)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197668	[2]
Spartium witches'-broom (SpaWB229)	Italy	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197672	[2]
Hemp dogbane yellows (HD1)	USA	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197674	[2]

Cherry lethal yellows (CLY5)	China	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197679	[2]
Peach yellows (PY-In)	India	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197680	[2]
Jujube witches'-broom (JWB)	China	<i>rpsV (rpl22), rpsC (rps3)</i>	AY197681	[2]
Elm yellows (E04-D714)	France	<i>map</i>	AM384901	[5]
Elm yellows (E04-D438)	France	<i>map</i>	AM384900	[5]
Elm yellows (NK16)	Croatia	<i>map</i>	KU202150	[22]
Elm yellows (DM1)	Croatia	<i>map</i>	KU202101	[22]
Elm yellows (J7)	Croatia	<i>map</i>	KU202118	[22]
Elm yellows (NK3)	Croatia	<i>map</i>	KU202146	[22]
Elm yellows (KP1)	Croatia	<i>map</i>	KU202129	[22]
Elm yellows (C5)	Croatia	<i>map</i>	KU202091	[22]
Elm yellows (DM20)	Croatia	<i>map</i>	KU202111	[22]
Elm yellows (J2)	Croatia	<i>map</i>	KU202115	[22]
Elm yellows (DM8)	Croatia	<i>map</i>	KU202104	[22]
Elm yellows (EY24-SRB)	Serbia	<i>map</i>	HM038480	[13]
Elm yellows (EY20-SRB)	Serbia	<i>map</i>	HM038479	[13]
Elm yellows (EY1-SRB)	Serbia	<i>map</i>	HM038471	[13]
Elm yellows (EY10-SRB)	Serbia	<i>map</i>	HM038474	[13]
Elm yellows (EY18-SRB)	Serbia	<i>map</i>	HM038478	[13]
Palatinate grapevine yellows-PGY-A-(EY17-49)-M53	Germany	<i>map</i>	AM384892	[5]
Palatinate grapevine yellows-PGY-B-(M48)-M48	Germany	<i>map</i>	AM384893	[5]
Palatinate grapevine yellows PGY-C-(EY38)-M46	Germany	<i>map</i>	AM384891	[5]
Alder yellows (ALY)-M36	Italy	<i>map</i>	AM384885	[5]
Alder yellows (AI-04-3-13)-M35	Italy	<i>map</i>	AM384884	[5]
Alder yellows (AF-09-22-48)-M106	France	<i>map</i>	LT222001	[25]
Alder yellows (OF-10-F5-16)-M110	France	<i>map</i>	LT222005	[25]
Rubus stunt (RUS)-Ca.P.rubi	Italy	<i>map</i>	AM384898	[5]
Spartium witches'-broom (SI04-S4)	Italy	<i>map</i>	AM384899	[5]
Hemp dogbane yellows (HD1)	USA	<i>map</i>	AM384902	[5]
Flavescence dorée (FD70)-M50	France	<i>map</i>	AM238512	[5]
Flavescence dorée (V03-9-2)-M27	France	<i>map</i>	AM384888	[5]
Flavescence dorée (V00-SP5)-M54	France	<i>map</i>	AM384886	[5]
Flavescence dorée (VF13-380)-M121	France	<i>map</i>	LT222016	[25]
Flavescence dorée (VI04-C28)-M3	Italy	<i>map</i>	AM384894	[5]
Flavescence dorée (VI04-Toscana1)-M6	Italy	<i>map</i>	AM384895	[5]
Elm yellows (ULW)	France	<i>imp</i>	MT418908	[6]
Elm yellows (4120-UI-SN)	Germany	<i>imp</i>	MT668488	[6]
Elm yellows (4157-Ug-SN)	Germany	<i>imp</i>	MT668489	[6]
Elm yellows (3998-Um-SN)	Germany	<i>imp</i>	MT668485	[6]
Elm yellows (1629-Um-BY)	Germany	<i>imp</i>	MT668450	[6]
Elm yellows (3400-Um-ST)	Germany	<i>imp</i>	MT668475	[6]
Elm yellows (2732-Um-BB)	Germany	<i>imp</i>	MT668465	[6]
Elm yellows (0485-Um-BW)	Germany	<i>imp</i>	MT668430	[6]
Alder yellows (ALY1)	Germany	<i>imp</i>	MT668499	[6]
Flavescence dorée (CH)	Switzerland	<i>imp</i>	CP097583	[17]
Flavescence dorée (FD-D)	Italy	<i>imp</i>	MK614707	[26]
Flavescence dorée (FD-C-Piemonte)	Italy	<i>imp</i>	KJ402359	[27]
Flavescence dorée (FD70)	France	<i>imp</i>	MT668500	[6]
Jujube witches'-broom (Jwb-nky)	China	<i>imp</i>	MG818479	[Gao R., Wang J., Lu X.]
Elm yellows (ULW)	France	<i>groEL</i>	MT418907	[6]
Elm yellows (1986-Um-RP)	Germany	<i>groEL</i>	MT638084	[6]
Elm yellows (1804-Ug-RP)	Germany	<i>groEL</i>	MT638079	[6]
Elm yellows (2291-UI-HE)	Germany	<i>groEL</i>	MT638087	[6]
Elm yellows (0955-Ug-BY)	Germany	<i>groEL</i>	MT638070	[6]
Elm yellows (EY)	Germany	<i>groEL</i>	MT638077	[6]
Elm yellows (6404-UI-NRW)	Germany	<i>groEL</i>	MT638096	[6]
Elm yellows (4120-UI-SN)	Germany	<i>groEL</i>	MT638093	[6]
Elm yellows (2906-UI-ST)	Germany	<i>groEL</i>	MT638089	[6]
Elm yellows (3716-Ug-NI)	Germany	<i>groEL</i>	MT638090	[6]
Elm yellows (JB0071-C04-CFIA7-2)	France	<i>groEL</i>	KJ939992	[28]
Alder yellows (ALY)	Italy	<i>groEL</i>	MT638097	[6]
Flavescence dorée (CH)	Switzerland	<i>groEL</i>	CP097583	[17]
Flavescence dorée (FD70)	France	<i>groEL</i>	MT638098	[6]

Jujube witches'-broom (Jwb-nky)	China	<i>groEL</i>	CP025121	[29]
Jujube witches'-broom (Hebei-2018)	China	<i>groEL</i>	CP091835	[30]

* 16S, 16S rDNA; SR, 16S/23S rDNA spacer region

Table S3. Summary of the pattern types (subgroups) produced by virtual RFLP analysis of ribosomal protein (rp) gene sequences [rp(V) F1A/rp(V)R1A fragments] of the newly detected elm yellows (EY) phytoplasma strains in southern Italy and rp sequences retrieved from the GenBank database. Numbers shown in each column represent distinct RFLP types with each enzyme.

Strain	Genbank Accession. No.	rpV subgroup*	RFLP pattern types								
			<i>Hpa</i> II	<i>Dra</i> I	<i>Taq</i> I	<i>Alu</i> I	<i>Mse</i> I	<i>Ssp</i> I	<i>Tsp509</i> I	<i>Hae</i> III	<i>Hha</i> I
EY1**	AY197675	A	1	1	1	1	1	1	1	1	1
EY125**	AY197676	A	1	1	1	1	1	1	1	1	1
EY626**	EY197677	A	1	1	1	1	1	1	1	1	1
EY627**	EY197677	A	1	1	1	1	1	1	1	1	1
ALY-(ALY)**	AY197666	H	2	3	1	1	3	2	4	1	1
ALY-(ALY882)**	AY197662	K	2	3	1	4	4	1	5	1	1
FD-(FD-C)**	AY197665	D	1	3	1	1	4	1	5	1	1
FD-(FD-D)**	AY197664	E	2	3	4	1	7	1	5	1	1
SpaWB-(SpaWB229)**	AY197672	L	2	4	5	1	3	3	8	1	1
EY2470	PP332813	A	1	1	1	1	1	1	1	1	1
EY2516	PP332814	A	1	1	1	1	1	1	1	1	1
EY2517	PP332815	A	1	1	1	1	1	1	1	1	1
EY2553	PP332816	A	1	1	1	1	1	1	1	1	1
EY2577	PP332817	A	1	1	1	1	1	1	1	1	1
EY2578	PP332818	A	1	1	1	1	1	1	1	1	1
EY2579	PP332819	A	1	1	1	1	1	1	1	1	1
EY2581	PP332820	A	1	1	1	1	1	1	1	1	1
EY2582	PP332821	A	1	1	1	1	1	1	1	1	1
EY2591	PP332822	A	1	1	1	1	1	1	1	1	1
EY2592	PP332823	A	1	1	1	1	1	1	1	1	1
EY2595	PP332824	A	1	1	1	1	1	1	1	1	1
EY2607	PP332825	A	1	1	1	1	1	1	1	1	1
EY2636	PP332826	A	1	1	1	1	1	1	1	1	1
EY2637	PP332827	A	1	1	1	1	1	1	1	1	1
EY2638	PP332828	A	1	1	1	1	1	1	1	1	1
EY2708	PP332829	A	1	1	1	1	1	1	1	1	1

* rp subgroup designation according to Lee et al. [2] and Martini et al. [31].

** Sequences retrieved from the GenBank database.

Table S4. Single nucleotide polymorphisms (SNPs) in the *map* gene sequences of newly detected elm yellows (EY) phytoplasma strains in southern Italy and reference phytoplasma strains.

Strain	Genbank Acc. No.	Map Genotype	SNPs																		
			21	29	32	97	159	176	267	315	378	388	394	423	427	490	499	555	558	665	666
E04-D714*	AM384901	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY24-SRB*	HM038480	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2466	PP332830	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2467	PP332831	M2**	A	A	A	T	A	T	T	T	T	A	G	G	G	A	T	T	T	A	C
EY2468	PP332832	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2469	PP332833	M3**	A	A	A	G	A	T	G	C	G	A	G	G	G	A	T	T	T	A	C
EY2470	PP332834	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2471	PP332835	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2476	PP332836	M4**	A	A	A	T	A	T	T	T	T	A	A	T	A	A	T	T	T	A	C
EY2477	PP332837	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2478	PP332838	M5**	A	A	A	T	A	T	T	T	T	A	A	G	A	A	T	T	T	A	C
EY2479	PP332839	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2516	PP332840	M6**	A	G	A	T	C	T	G	T	T	C	G	T	G	C	C	T	T	A	C
EY2517	PP332841	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2553	PP332842	M7**	A	A	G	T	A	T	G	C	G	A	G	G	G	A	T	T	C	A	C
EY2554	PP332843	M8**	A	A	A	T	A	T	T	T	T	A	G	G	A	A	T	T	T	A	C
EY2577	PP332844	M8**	A	A	A	T	A	T	T	T	T	A	G	G	A	A	T	T	T	A	C
EY2578	PP332845	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2579	PP332846	M9**	G	A	A	T	A	T	G	T	T	A	G	T	G	A	T	T	T	A	C
EY2581	PP332847	M10**	A	A	A	T	A	T	G	T	T	A	G	G	G	A	T	T	T	A	C
EY2582	PP332848	M11**	A	A	A	T	A	T	G	C	T	A	G	G	G	A	T	T	T	A	C
EY2591	PP332849	M12**	A	A	A	T	A	T	G	T	G	A	G	G	G	A	T	C	T	A	C
EY2595	PP332850	M13**	A	A	A	T	A	T	G	C	G	A	G	G	G	A	T	T	T	A	C
EY2596	PP332851	M2	A	A	A	T	A	T	T	T	T	A	G	G	G	A	T	T	T	A	C
EY2607	PP332852	M14**	A	A	A	T	A	C	G	T	T	A	G	G	G	A	T	C	T	C	T
EY2608	PP332853	M13**	A	A	A	T	A	T	G	C	G	A	G	G	G	A	T	T	T	A	C
EY2635	PP332854	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2636	PP332855	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2637	PP332856	M1	A	A	A	T	A	T	T	T	T	A	G	T	G	A	T	T	T	A	C
EY2638	PP332857	M15**	A	A	A	T	A	T	G	T	G	A	G	G	G	A	T	T	T	A	C

*Reference phytoplasma strain [5, 13, 22].

** Newly identified.

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