

SUPPLEMENTARY MATERIAL

Supplementary Table S1: Samples collected from Villavieja (León, Spain: 42.485015, -6.684764, 765 MASL) in June 2017 used for sequencing and microbial isolation. Tree or bush identifier, common name, family and genus of tree or bush, degree of degradation (based on: Swedish National Forest Inventory, NFI), and number of species isolated from each sample and percentage over the whole isolates are indicated. Note that one tree generates more than one analyzed sample (e.g.: Pe has two samples).

| Sample | Common name | Family, genus | NFI | No. of isolates (%) |
|-----------------|------------------|------------------------------|---------|---------------------|
| Pe (Pe2) | Common pear | Rosaceae, <i>Pyrus</i> | 4.0 | 14 (1.9) |
| Cn1 | Spanish chestnut | Fagaceae, <i>Castanea</i> | 2.0-2.5 | 57 (7.9) |
| Ol | European olive | Oleaceae, <i>Olea</i> | 1.0 | 24 (3.3) |
| Oa | European oak | Fagaceae, <i>Quercus</i> | 2.0 | 36 (5.0) |
| Wi | Basket willow | Saliaceae, <i>Salix</i> | 1.5-2.0 | 55 (7.6) |
| Pe (Pe1) | Common pear | Rosaceae, <i>Pyrus</i> | 1.0 | 29 (4.0) |
| Ah | European ash | Oleaceae, <i>Fraxinus</i> | 2.0 | 15 (2.1) |
| Wa | English walnut | Juglandaceae, <i>Juglans</i> | 3.0 | 109 (15.1) |
| M | Common mulberry | Moraceae, <i>Morus</i> | 1.5 | 40 (5.6) |
| Cn2 | Spanish chestnut | Fagaceae, <i>Castanea</i> | 2.0-2.5 | 12 (1.7) |
| Cn4 | Spanish chestnut | Fagaceae, <i>Castanea</i> | 1.5 | 43 (6.0) |
| F | Common fig | Moraceae, <i>Ficus</i> | 1.5-2.0 | 35 (4.9) |
| Cr1 | Wild cherry | Rosaceae, <i>Prunus</i> | 1.0-1.5 | 39 (5.4) |
| Cr2 | Wild cherry | Rosaceae, <i>Prunus</i> | 3.0-3.5 | 31 (4.3) |

Supplementary Table S2: Screening of PKS/NRPSs genes in Actinobacteria and results of antifungal activity bioassay. The presence of absence of the biosynthetic genes detected by PCR is coded as, “+” PCR amplification and “-“ no PCR amplification. The average score is the media of the results of each antagonistic specie *versus* the reporter species (*Aspergillus brasiliensis*, *Aureobasidium pullulans*, *Coniophora puteana*, *Penicillium chrysogenum* and *Trametes versicolor*). The intensity of the inhibition was rated from 0 to 2, where 0 is no inhibitory effect and 2 is total inhibition

| Species | Code | PKS-I K1F/M6R | PKS –II KSF/KSR | NRPS A3R/A7R | Average score |
|--|--------|------------------|--------------------|-----------------|------------------|
| <i>Agromyces</i> sp. | V3C5 | - | - | - | - |
| <i>Agromyces terreus</i> | V42i11 | - | + | + | 0.0 |
| <i>Agromyces terreus</i> | V42i12 | - | - | + | - |
| <i>Arthrobacter agilis</i> | V8C9 | - | + | + | 0.0 |
| <i>Arthrobacter agilis</i> | V12i11 | - | + | + | - |
| <i>Arthrobacter citreus</i> | V12C7 | - | + | + | 0.4 |
| <i>Arthrobacter rhombi</i> | V2C5 | - | - | - | 1.2 |
| <i>Arthrobacter</i> sp. | V12C2 | - | + | + | 1.0 |
| <i>Arthrobacter</i> sp. | V8C6 | - | + | - | 1.2 |
| <i>Brachybacterium tyrofermentans</i> | V2i6 | - | - | - | - |
| <i>Brevibacterium</i> sp. | C7i1 | - | - | - | - |
| <i>Brevibacterium</i> sp. | V42C46 | - | + | - | - |
| <i>Cellulomonas</i> sp. | C7C14 | - | + | + | 1.2 |
| <i>Curtobacterium flaccumfaciens</i> | V42C25 | - | + | + | 0.8 |
| <i>Curtobacterium flaccumfaciens</i> | V2C4 | - | + | + | - |
| <i>Curtobacterium oceanosedimentum</i> | V4C13 | - | - | - | - |
| <i>Curtobacterium</i> sp. | V3C6 | - | - | + | - |
| <i>Janibacter melonis</i> | V42C22 | - | + | + | 0.8 |
| <i>Kocuria rhizophila</i> | V13S1 | - | - | - | - |
| <i>Leifsonia poae</i> | C7C10 | - | + | + | 0.0 |
| <i>Leucobacter alluvii</i> | V36S5 | - | + | + | 1.1 |
| <i>Microbacterium oxydans</i> | V4C4 | - | - | - | 0.0 |
| <i>Microbacterium oxydans</i> | V8C5 | - | + | + | 1.3 |
| <i>Microbacterium phyllosphaerae</i> | V4C3 | - | - | - | 0.4 |
| <i>Microbacterium</i> sp. | V3C11 | - | + | + | 0.0 |
| <i>Microbacterium</i> sp. | C7C3 | - | + | + | 0.4 |
| <i>Microbacterium</i> sp. | V12C5 | - | + | + | 1.1 |
| <i>Micrococcus luteus</i> | V12i9 | - | - | - | - |
| <i>Micrococcus luteus</i> | V5i4 | - | - | + | - |
| <i>Micrococcus luteus</i> | V4i7 | - | - | + | - |
| <i>Micrococcus terreus</i> | V12C4 | - | + | - | - |
| <i>Nocardioides albus</i> | V56S2 | - | - | - | - |
| <i>Nocardioides</i> sp. | C7C9 | - | + | + | 0.0 |
| <i>Nocardioopsis umidischolae</i> | V3C7 | - | - | - | 1.4 |
| <i>Oerskovia enterophila</i> | V3i1 | - | - | - | - |
| <i>Oerskovia paurometabola</i> | V3i13 | - | - | - | - |
| <i>Promicromonospora</i> sp. | V56C15 | - | - | - | - |
| <i>Rhodococcus erythropolis</i> | V8i7 | - | - | + | 0.0 |
| <i>Rhodococcus erythropolis</i> | C7S1 | - | - | + | - |

| | | | | | |
|-----------------------------------|--------|---|---|---|-----|
| <i>Rhodococcus fascians</i> | C7C6 | - | + | + | 0.8 |
| <i>Rhodococcus globerulus</i> | V2i2 | - | - | - | 1.2 |
| <i>Rhodococcus globerulus</i> | V2S4 | - | + | + | - |
| <i>Rhodococcus opacus</i> | C7i4 | + | - | + | 1.0 |
| <i>Rhodococcus</i> sp. | V12C3 | - | - | + | - |
| <i>Sediminihabitans luteus</i> | V3C22 | - | + | - | - |
| <i>Streptomyces candidus</i> | V12i3 | + | + | + | 0.2 |
| <i>Streptomyces drozdowiczii</i> | V3i17 | + | + | + | 0.2 |
| <i>Streptomyces fimicarius</i> | V56S1 | - | + | + | 1.8 |
| <i>Streptomyces flavogriseus</i> | V36C4 | - | + | + | 0.2 |
| <i>Streptomyces flavogriseus</i> | V1i7 | + | + | + | - |
| <i>Streptomyces fractus</i> | V42C52 | - | + | + | 0.2 |
| <i>Streptomyces griseus</i> | V3i9 | - | + | + | 0.4 |
| <i>Streptomyces hygroscopicus</i> | V42C49 | - | - | - | 0.0 |
| <i>Streptomyces kanamyceticus</i> | V5i1 | + | + | + | 1.4 |
| <i>Streptomyces laculatispora</i> | C7S7 | + | + | + | 1.0 |
| <i>Streptomyces lavendulae</i> | V5S6 | - | - | + | 1.0 |
| <i>Streptomyces lavendulae</i> | V56C10 | - | - | - | - |
| <i>Streptomyces niveus</i> | V56S7 | + | + | + | 1.8 |
| <i>Streptomyces</i> sp. | V17C6 | - | + | + | 0.0 |
| <i>Streptomyces</i> sp. | V5S7 | - | + | + | 0.0 |
| <i>Streptomyces</i> sp. | V56C17 | - | + | + | 0.2 |
| <i>Streptomyces</i> sp. | V2S3 | + | + | + | 0.4 |
| <i>Streptomyces</i> sp. | V42C42 | - | + | + | 0.8 |
| <i>Streptomyces</i> sp. | C7C8 | + | + | + | 1.0 |
| <i>Streptomyces</i> sp. | V5i2 | - | + | + | 1.4 |
| <i>Streptomyces</i> sp. | V5C2 | - | - | - | 1.4 |
| <i>Streptomyces</i> sp. | C7i7 | - | + | + | 1.8 |
| <i>Streptomyces</i> sp. | V12S5 | - | - | + | - |
| <i>Streptomyces</i> sp. | V42C43 | - | + | + | - |
| <i>Streptomyces</i> sp. | V42C48 | - | + | + | - |
| <i>Streptomyces</i> sp. | V42C50 | - | + | - | - |
| <i>Streptomyces</i> sp. | V42C51 | - | + | + | - |
| <i>Streptomyces thinghirensis</i> | V42C55 | + | + | + | 0.4 |
| <i>Streptomyces violaceolatus</i> | V42C53 | - | + | + | 0.8 |
| <i>Williamsia muralis</i> | V12C9 | - | - | + | - |
| <i>Williamsia</i> sp. | C7C13 | - | - | + | - |

Supplementary Table S3. Screening of PKS/NRPSs genes in *Penicillium* sp. and results of antifungal activity bioassay. The presence of absence of the biosynthetic genes detected by PCR is coded as, “+” PCR amplification and “-“ no PCR amplification. The average score is the media of the results of each antagonistic species *versus* the reporter species (*Aspergillus brasiliensis*, *Aureobasidium pullulans*, *Coniophora puteana*, *Penicillium chrysogenum* and *Trametes versicolor*). The intensity of the inhibition was rated from 0 to 2, where 0 is no inhibitory effect and 2 is total inhibition

| Species | Code | PKSs | | | | NRPS | Average score |
|-------------------------------------|--------|-----------------|-----------------|---------------|---------------|---------------|---------------|
| | | KAF1F/ KAR2R | KAF2F/ KAR1R | LC3F/ LC5R | LC1F/ LC2R | AUG3/ AUG7 | |
| <i>Penicillium aeneum</i> | V42C66 | + | - | - | + | - | 1.2 |
| <i>Penicillium melinii</i> | E2C16 | + | - | + | + | - | 1.4 |
| <i>Penicillium brevicompactum</i> | V12S13 | + | - | + | - | - | 0.2 |
| <i>Penicillium charlesii</i> | V42C63 | + | + | + | + | - | 1.4 |
| <i>Penicillium citreosulfuratum</i> | E2C22 | + | + | + | + | - | 1.0 |
| <i>Penicillium citrinum</i> | V8C33 | + | - | + | + | - | 1.4 |
| <i>Penicillium corylophilum</i> | V8C26 | + | + | + | + | - | 1.0 |
| <i>Penicillium crustosum</i> | V12S27 | + | - | - | + | - | - |
| <i>Penicillium decaturense</i> | V8C31 | + | - | - | - | - | 0.4 |
| <i>Penicillium expansum</i> | V8C64 | + | - | - | - | - | 1.8 |
| <i>Penicillium fellutanum</i> | V12C22 | + | + | - | - | - | - |
| <i>Penicillium glabrum</i> | C7C19 | - | - | - | - | - | - |
| <i>Penicillium kojigenum</i> | V1C11 | + | - | + | + | - | - |
| <i>Penicillium melinii</i> | E2i14 | + | + | - | + | + | - |
| <i>Penicillium citreonigrum</i> | V42C34 | + | - | - | - | - | - |
| <i>Penicillium murcianum</i> | V8i77 | - | - | - | - | - | 0.8 |
| <i>Penicillium pancosmium</i> | V8i103 | + | - | - | + | - | - |
| <i>Penicillium raistrickii</i> | V4i29 | + | - | - | + | - | - |
| <i>Penicillium roseopurpureum</i> | C7C18 | - | - | - | - | - | - |
| <i>Penicillium sanguifluum</i> | C7S22 | + | + | + | + | - | - |
| <i>Penicillium spinulosum</i> | C7C21 | + | - | - | - | - | - |
| <i>Penicillium steckii</i> | V8i101 | + | + | - | - | - | - |
| <i>Penicillium toxicarium</i> | V8C126 | + | - | + | + | - | 1.0 |
| <i>Penicillium ubiquetum</i> | V12C15 | - | - | - | - | - | 0.0 |
| <i>Penicillium</i> sp. | E2S10 | + | - | + | + | - | 1.6 |
| <i>Penicillium</i> sp. | V12C13 | + | - | + | - | - | 1.0 |
| <i>Penicillium</i> sp. | V3i21 | - | - | + | - | - | - |
| <i>Penicillium</i> sp. | V3i25 | + | - | + | + | - | - |
| <i>Penicillium</i> sp. | V4S2 | + | - | + | + | - | 1.0 |
| <i>Penicillium</i> sp. | V8C58 | + | - | - | - | - | - |
| <i>Penicillium</i> sp. | V8i58 | + | - | + | + | - | - |
| <i>Penicillium</i> sp. | V4C32 | + | + | + | + | - | 0.4 |

Supplementary Table S4: Results of cellulolytic and feruloyl esterase activity assays. A clear halo indicating the presence of the enzyme is indicated as “+”, and the absence of the halo as “-”.

| Species | Code | Enzymes | | |
|-------------------------------------|--------|-------------------------------|------------|--------------------|
| | | 1, 4- β -endoglucanases | Cellulases | Feruloyl esterases |
| <i>Penicillium aeneum</i> | V42C66 | + | + | + |
| <i>Penicillium melinii</i> | E2C16 | + | + | + |
| <i>Penicillium brevicompactum</i> | V12S13 | + | + | - |
| <i>Penicillium charlesii</i> | V42C63 | + | + | + |
| <i>Penicillium citreosulfuratum</i> | E2C22 | + | + | + |
| <i>Penicillium citrinum</i> | V8C33 | + | + | + |
| <i>Penicillium corylophilum</i> | V8C26 | + | - | + |
| <i>Penicillium decaturense</i> | V8C31 | + | + | + |
| <i>Penicillium expansum</i> | V8C64 | + | + | - |
| <i>Penicillium glabrum</i> | C7C19 | + | + | - |
| <i>Penicillium kojigenum</i> | V1C11 | + | - | - |
| <i>Penicillium citreonigrum</i> | V42C34 | + | - | - |
| <i>Penicillium murcianum</i> | V8i77 | + | + | - |
| <i>Penicillium toxicarium</i> | V8C126 | + | + | + |
| <i>Penicillium</i> sp. | E2S10 | - | + | + |
| <i>Penicillium</i> sp. | V12C13 | - | - | - |
| <i>Penicillium</i> sp. | V3i25 | + | + | - |
| <i>Penicillium</i> sp. | V4S2 | + | - | + |
| <i>Penicillium</i> sp. | V4C32 | - | - | + |