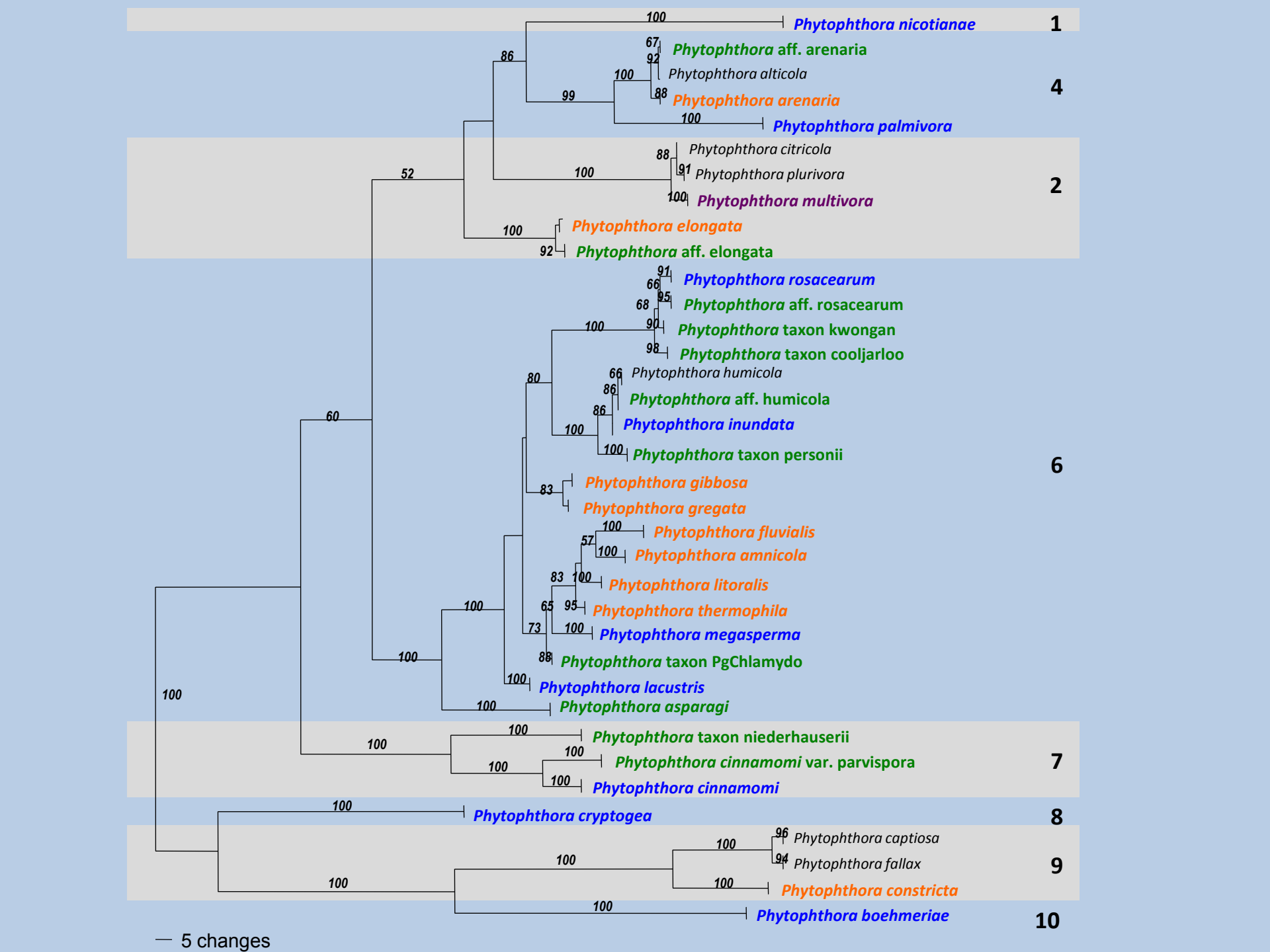
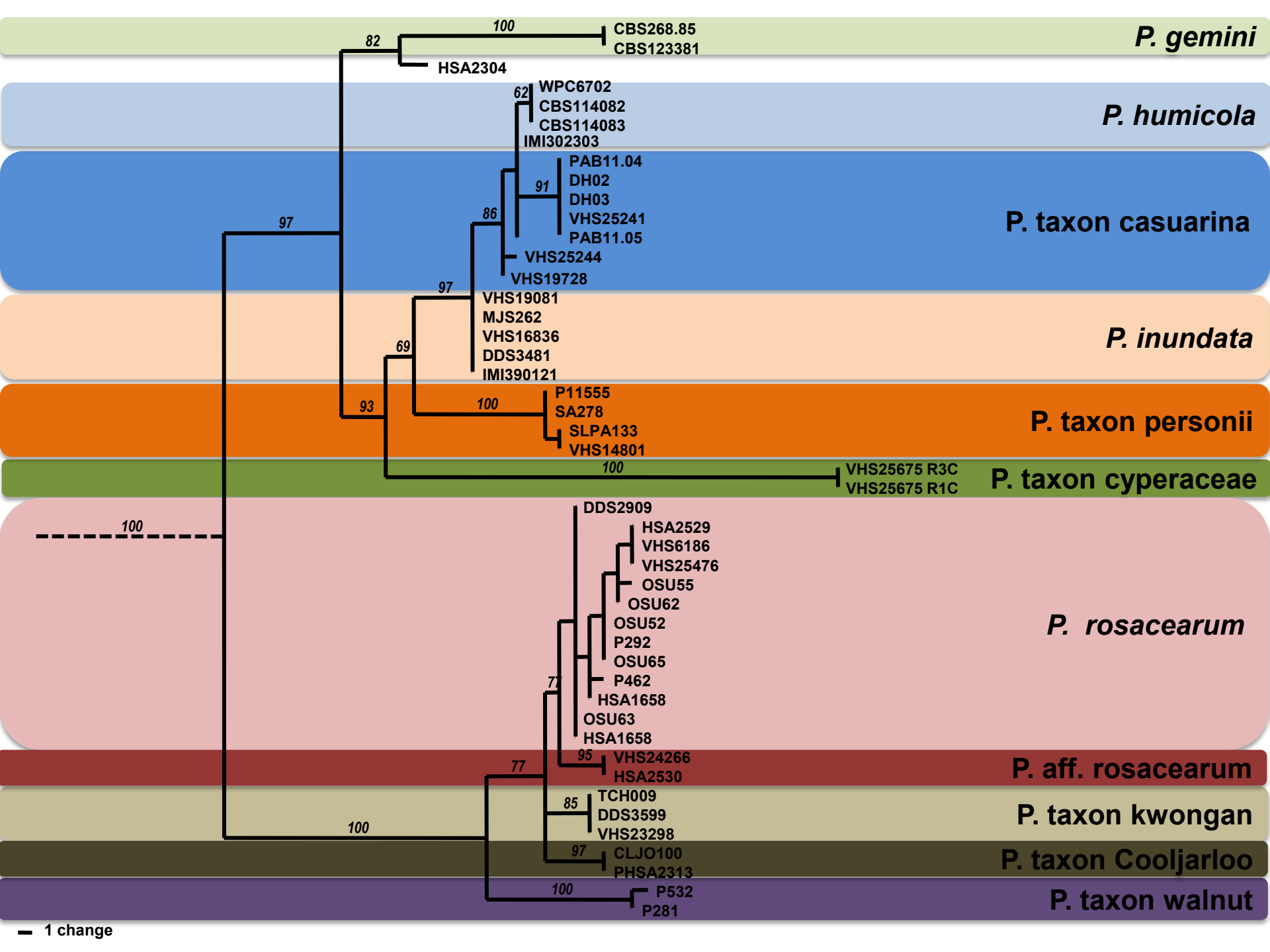
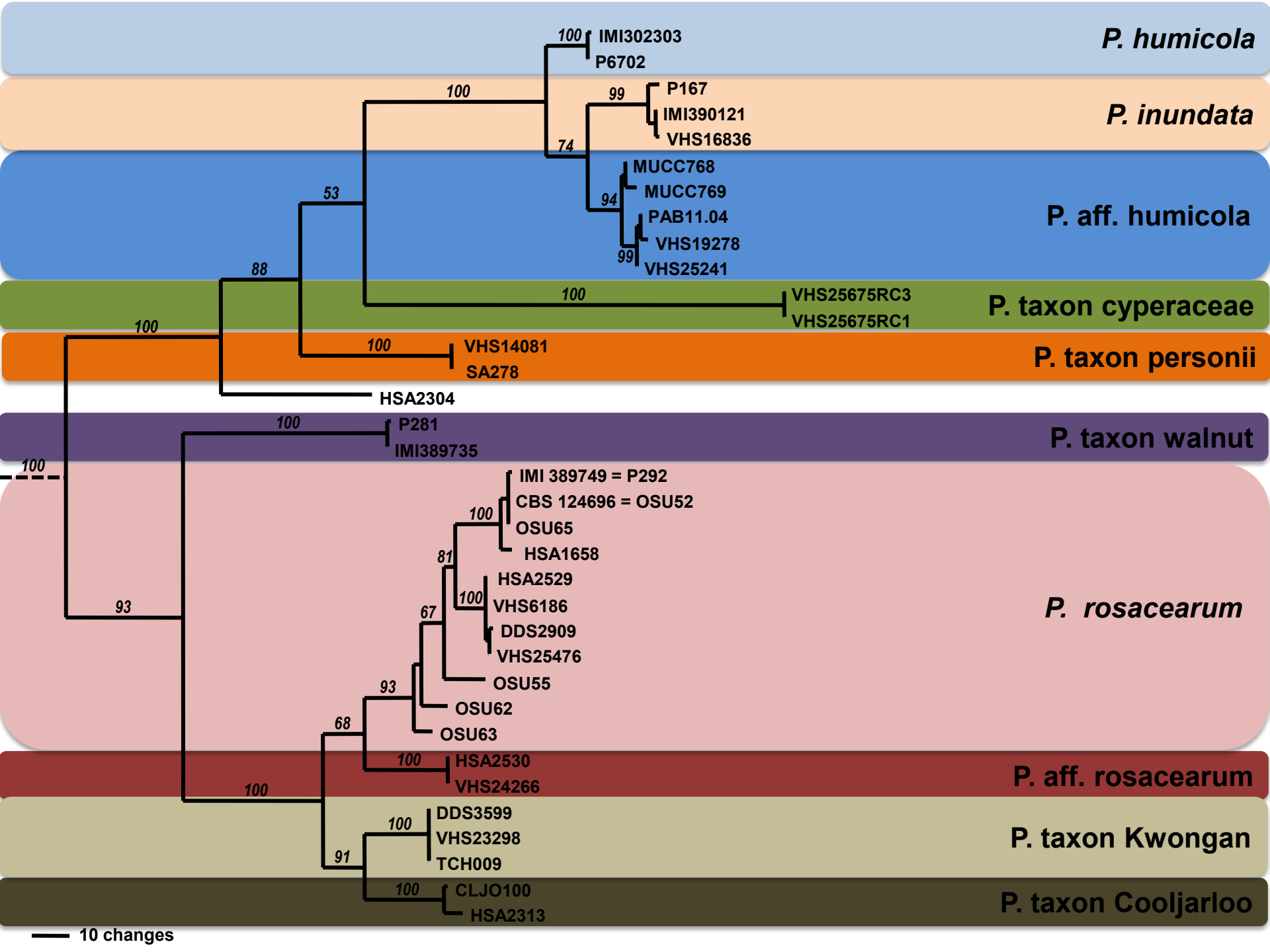
More new *Phytophthora* species from natural ecosystems in Western Australia

Agnes Simamora, Giles Hardy, Mike Stukely and Treena Burgess


Phytophthora nicotianae
Phytophthora aff. arenaria
Phytophthora alticola
Phytophthora arenaria
Phytophthora palmivora
Phytophthora citricola
Phytophthora plurivora
Phytophthora multivora
Phytophthora elongata
Phytophthora aff. elongata
Phytophthora rosacearum
Phytophthora aff. rosacearum
Phytophthora taxon kwongan
Phytophthora taxon cooljarloo
Phytophthora humicola
Phytophthora aff. humicola
Phytophthora inundata
Phytophthora taxon personii
Phytophthora gibbosa
Phytophthora gregata
Phytophthora fluvialis
Phytophthora amnicola
Phytophthora litoralis
Phytophthora thermophila
Phytophthora megasperma
Phytophthora taxon PgChlamydo
Phytophthora lacustris
Phytophthora asparagi
Phytophthora taxon niederhauserii
Phytophthora cinnamomi var. parvispora
Phytophthora cinnamomi
Phytophthora cryptogea
Phytophthora captiosa
Phytophthora fallax
Phytophthora constricta
Phytophthora boehmeriae
1
4
2
6
7
8
9
10
5 changes

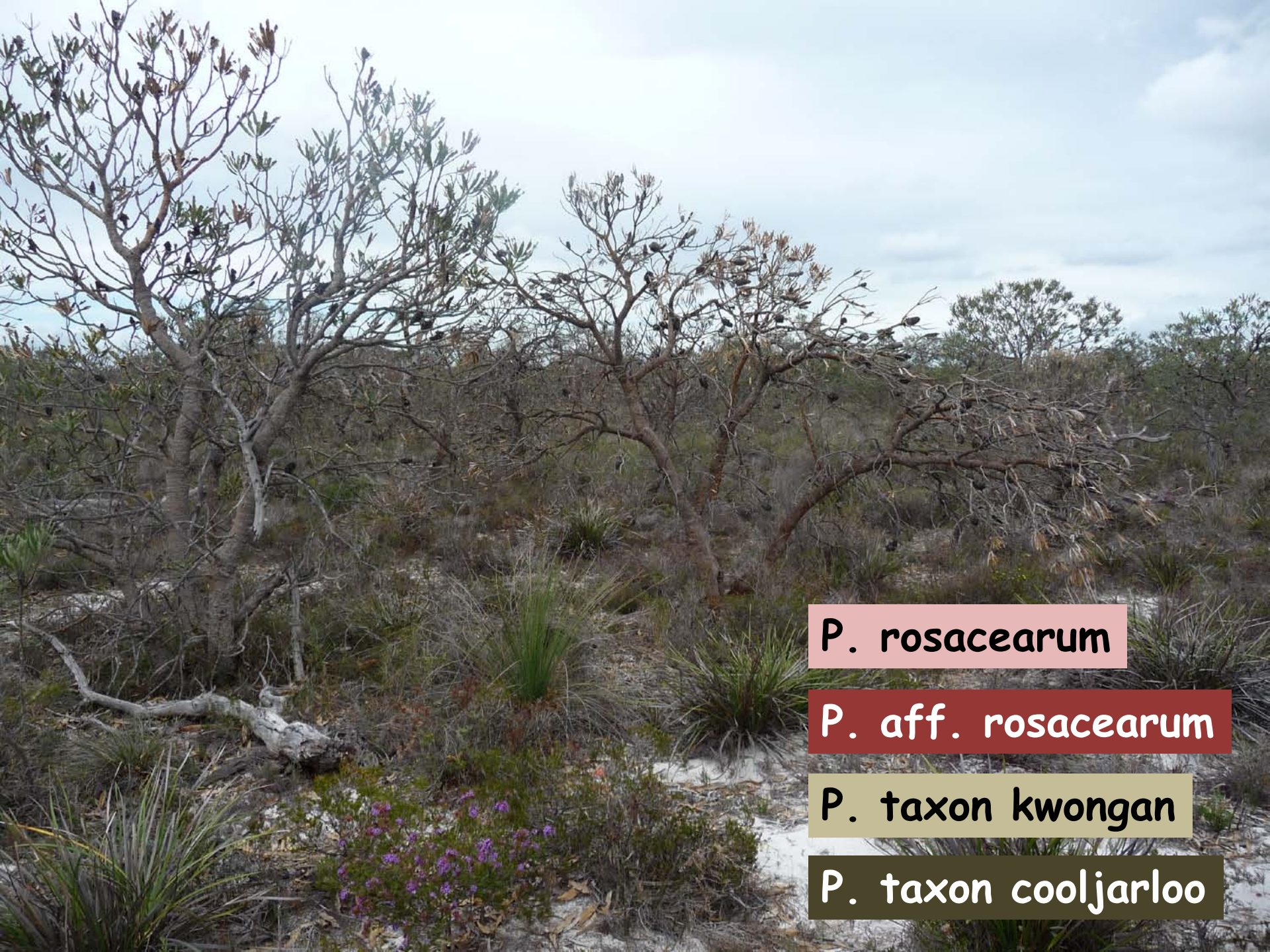

P. gemini
CBS268.85
CBS123381
HSA2304
P. humicola
WPC6702
CBS114082
CBS114083
IMI302303
P. taxon casuarina
PAB11.04
DH02
DH03
VHS25241
PAB11.05
VHS25244
VHS19728
P. inundata
VHS19081
MJS262
VHS16836
DDS3481
IMI390121
P. taxon personii
P11555
SA278
SLPA133
VHS14801
P. taxon cyperaceae
VHS25675 R3C
VHS25675 R1C
P. rosacearum
DDS2909
HSA2529
VHS6186
VHS25476
OSU55
OSU62
OSU52
P292
OSU65
P462
HSA1658
OSU63
HSA1658
P. aff. rosacearum
VHS24266
HSA2530
P. taxon kwongan
TCH009
DDS3599
VHS23298
P. taxon Cooljarloo
CLJO100
PHSA2313
P. taxon walnut
P532
P281
1 change

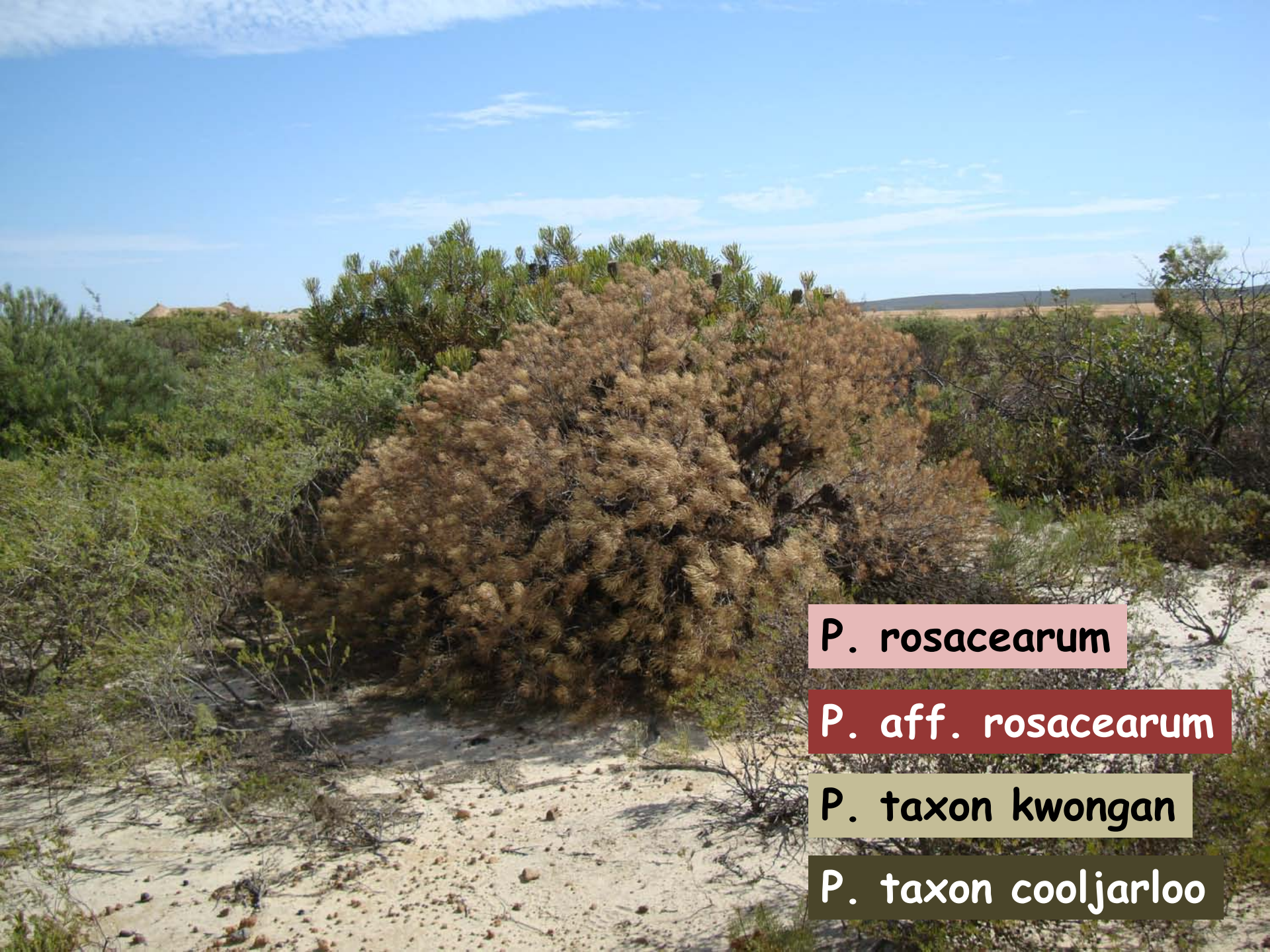

P. humicola
P. inundata
P. aff. humicola
P. taxon cyperaceae
P. taxon personii
P. taxon walnut
P. rosacearum
P. aff. rosacearum
P. taxon Kwongan
P. taxon Cooljarloo
IMI302303
P6702
P167
IMI390121
VHS16836
MUCC768
MUCC769
PAB11.04
VHS19278
VHS25241
VHS25675RC3
VHS25675RC1
VHS14081
SA278
HSA2304
P281
IMI389735
IMI 389749 = P292
CBS 124696 = OSU52
OSU65
HSA1658
HSA2529
VHS6186
DDS2909
VHS25476
OSU55
OSU62
OSU63
HSA2530
VHS24266
DDS3599
VHS23298
TCH009
CLJO100
HSA2313
100
99
74
53
94
88
67
81
93
68
91
10 changes

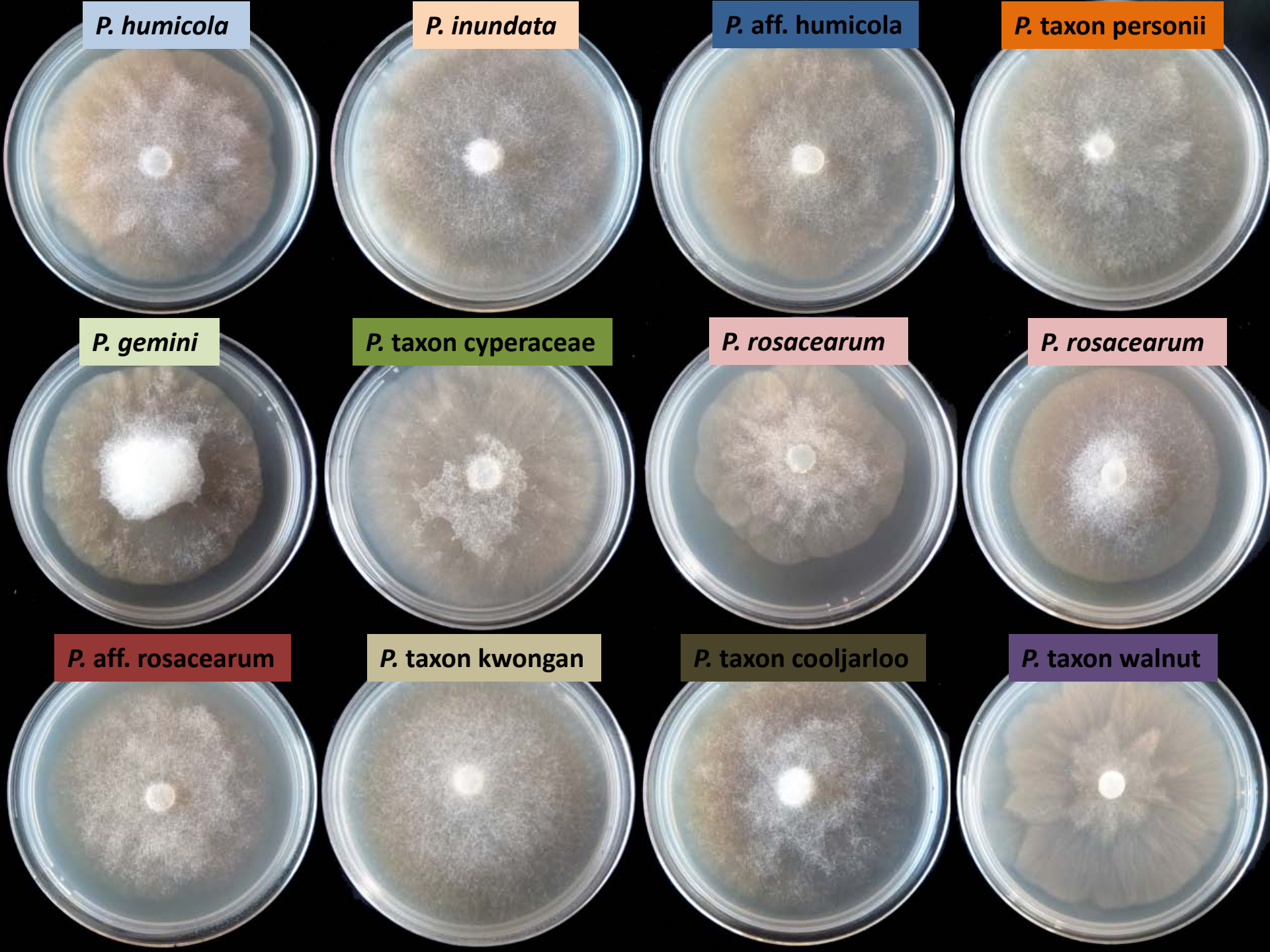
	host	distribution
P. humicola	*Citrus, Phaseolus*	Taiwan, Japan
P. aff humicola	*Casuarina obesa*	Western Australia
P. inundata	numerous	Western Australia, Europe
P. taxon personii	*Nicotiana, Grevillea*	Western Australia, USA
P. gemini	*Zostera marina*	the Netherlands
P. taxon cyperaceae	Sedge	Western Australia
P. rosacearum	*Malus, Prunus, Pinus, Xanthorrhoea*	Western Australia, USA
P. aff. rosacearum	native vegetation	Western Australia
P. taxon kwongan	*Banksia, Xanthorrhoea*	Western Australia
P. taxon cooljarloo	*Hibbertia*	Western Australia
P. taxon walnut	*Juglans*	USA (California)

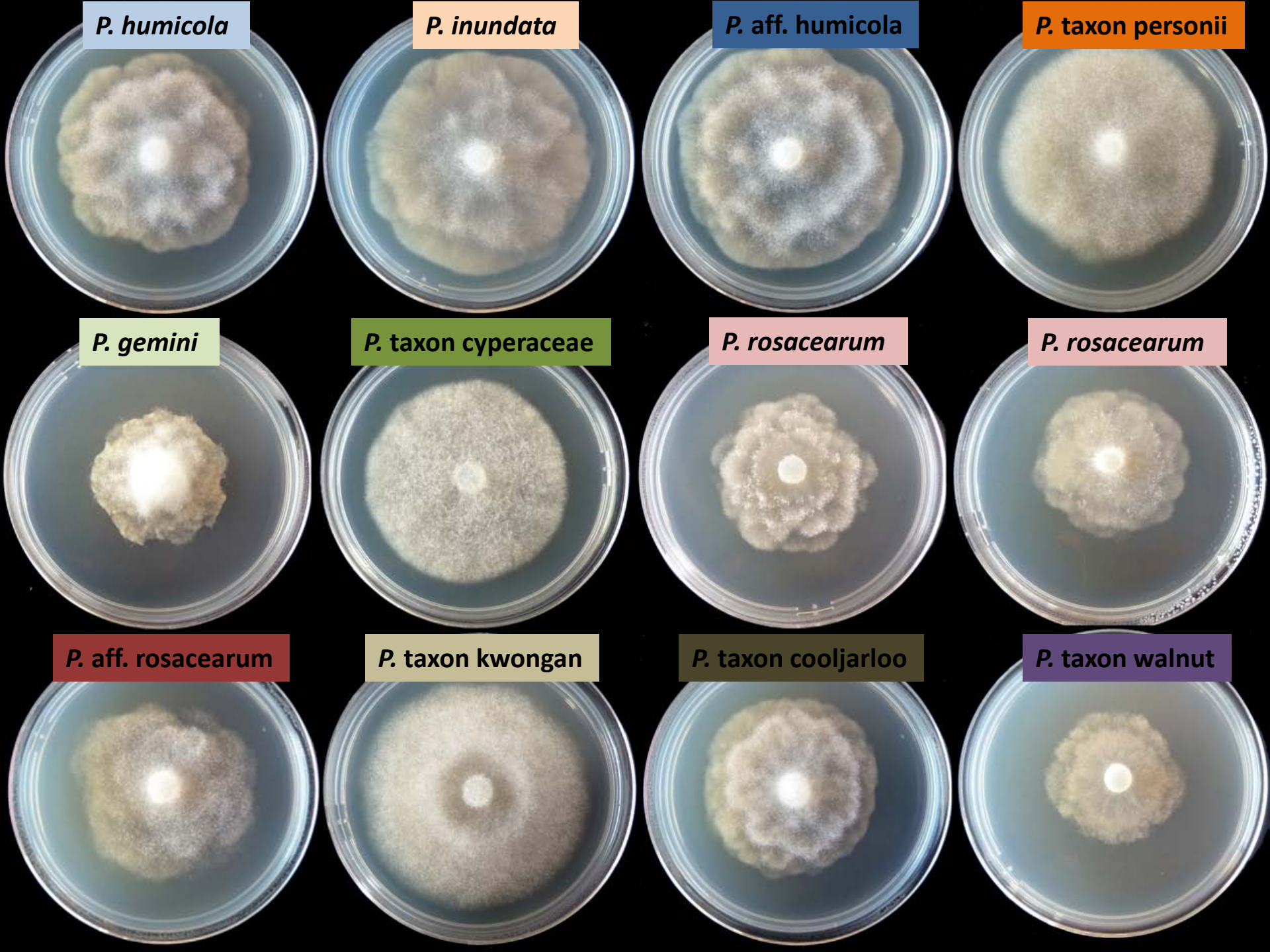
P. aff. humicola

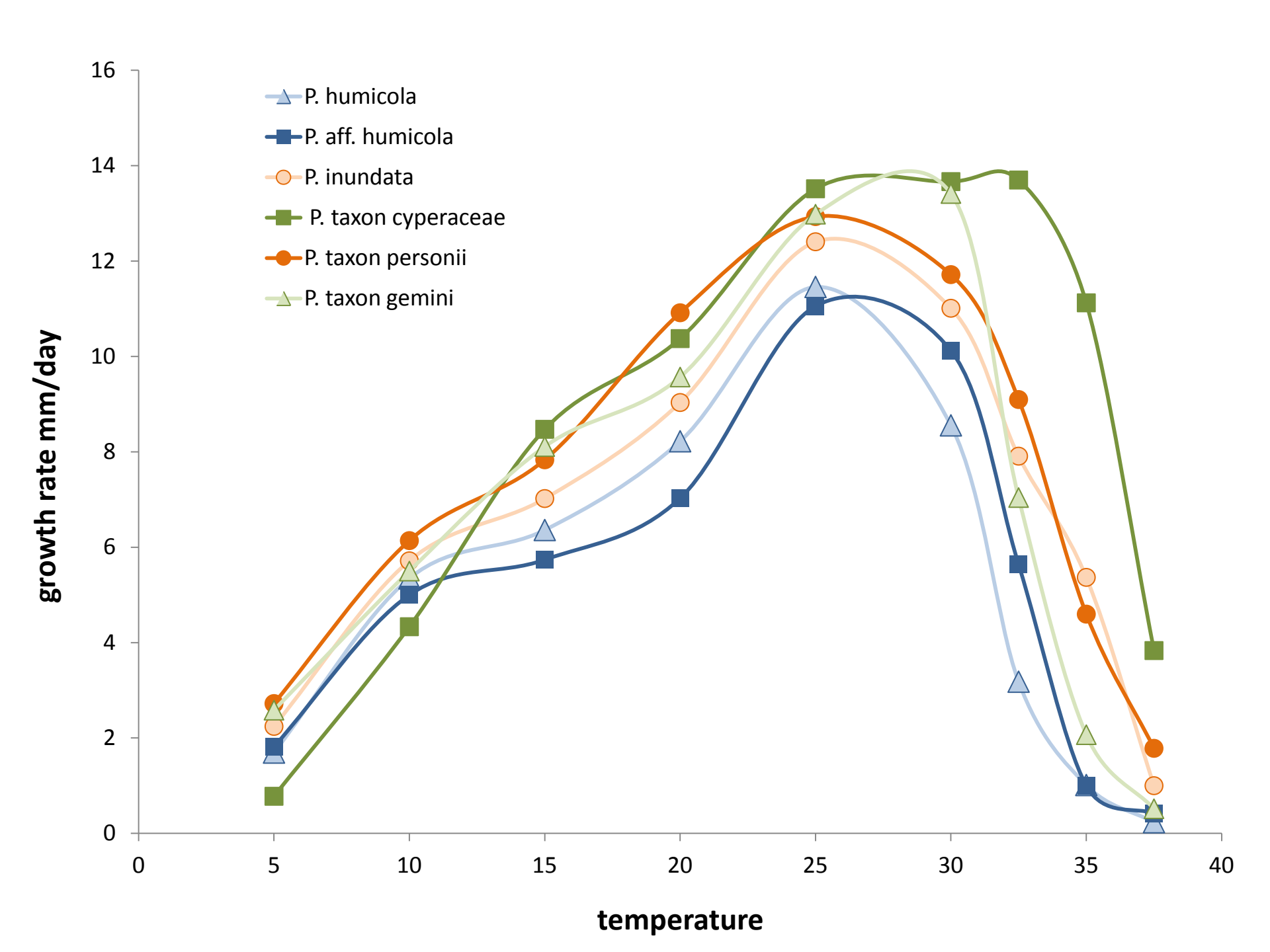
P. aff. cyperaceae

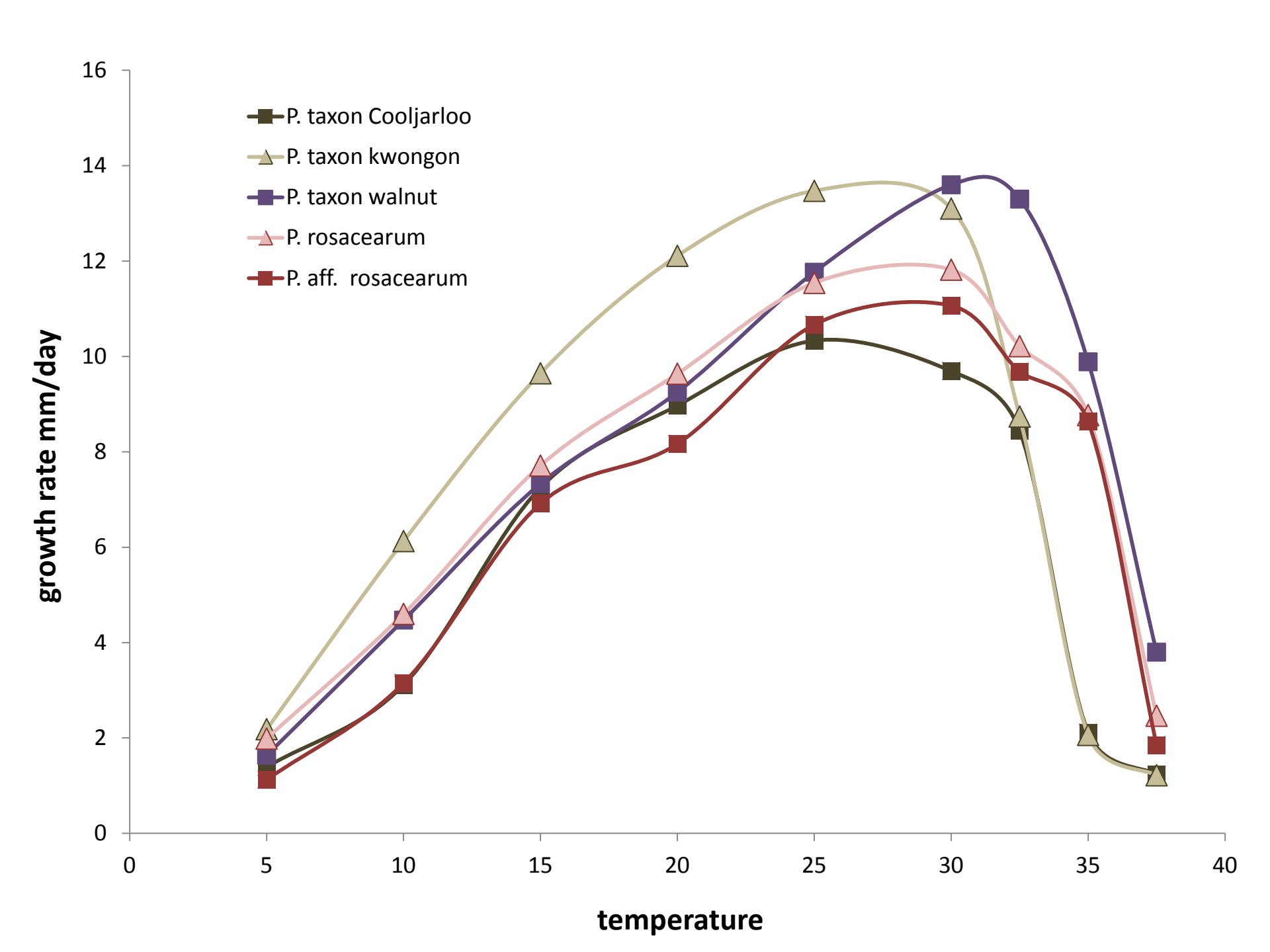

P. rosacearum
P. aff. rosacearum
P. taxon kwongan
P. taxon cooljarloo


P. rosacearum
P. aff. rosacearum
P. taxon kwongan
P. taxon cooljarloo


P. humicola
P. inundata
P. aff. humicola
P. taxon personii
P. gemini
P. taxon cyperaceae
P. rosacearum
P. rosacearum
P. aff. rosacearum
P. taxon kwongan
P. taxon cooljarloo
P. taxon walnut


P. humicola
P. inundata
P. aff. humicola
P. taxon personii
P. gemini
P. taxon cyperaceae
P. rosacearum
P. rosacearum
P. aff. rosacearum
P. taxon kwongan
P. taxon cooljarloo
P. taxon walnut


P. humicola
P. aff. humicola
P. inundata
P. taxon cyperaceae
P. taxon personii
P. taxon gemini
growth rate mm/day
temperature
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30
35
40


P. taxon Cooljarloo
P. taxon kwongon
P. taxon walnut
P. rosacearum
P. aff. rosacearum
growth rate mm/day
temperature
0
2
4
6
8
10
12
14
16
0
5
10
15
20
25
30
35
40

	optimum	max	>37.5
P. humicola	25	35	
P. aff humicola	27	35	
P. inundata	25	37.5	
P. taxon personii	25	>37.5	+++
P. gemini	30	35	
P. taxon cyperaceae	25-32.5	>37.5	+++
P. rosacearum	30	>37.5	+++
P. aff. rosacearum	30	>37.5	+++
P. taxon kwongan	27	37.5	
P. taxon cooljarloo	25	37.5	
P. taxon walnut	30	>37.5	+++

	mating	sporangia (av)	ov (%)	obp (%)	ell (%)
P. humicola	homothallic	40 x 28	100		
P. aff humicola	homothallic	48 x 33	100		
P. inundata	mixed	47 x 30	95	5	
P. taxon personii	?	44 x 29	90	10	
P. gemini	sterile	62 x 38	80	20	
P. taxon cyperaceae	?	62 x 36	35	65	
P. rosacearum	homothallic	47 x 26	50	10	40
P. aff. rosacearum	homothallic	38 x 25	80	10	10
P. taxon kwongon	homothallic	44 x 27	65		35
P. taxon cooljarloo	homothallic	56 x 35	100		
P. taxon walnut	sterile ?	52 x 28	30	70	

- continued exploration within natural ecosystems is Western Australia is uncovering more new species
- the northern Kwongan vegetation is home to numerous species form ITS Clade 6, sub-clade I
- unlike newly described species from ITS Clade 6, sub-clade II which are predominantly found in waterways, these new species are associated with disease
- we are establishing pathogenicity trials with 10 host species of known susceptibility to other Phytophthoras
- when considering the biodiversity and distribution of species form ITS Clade 6, sub-clade I, could Western Australia be the origin of this clade?