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番椒(*Capsicum* spp.)品系抗青枯病之篩選[1]

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摘要：以剪葉接種法評估不同番椒品系對青枯病菌(*Ralstonia solanacearum*)之抗感性，共評估二批材料，計 123個品系。第一批供試35個品種(系)，皆爲辣椒類型，其中包含 13 個臺灣商業品種與 22 個農試所自交系，發病指數最低爲 11.4%，最高爲 100%，而高抗、抗、感、高感病等級各有 2、19、11 及 3 個品種(系)，顯示品種(系)間抗感病性差異明顯。供試品種(系)中達高抗病者爲自交系的'4207-5-37-4-2-2-5'與'4207-16-45-2-2-1-1'，但商業品種中'生生199'、'美香'、'生生193'、'生生194'、'千里香'等 5 個品種達抗病的等級，屬高感病等級者爲商業品種的'長香'、'新香'及'生生197'。自留品系在高抗、抗、感及高感四等級的比率分別占 9.2、63.6、27.2 及 0%，而商業品種則爲 0、38.5、38.5 及 23.0%，顯示選留品系較商業品種抗青枯病。第二批供試 88 個品種(系)，包括辣椒與甜椒類型，爲來自國家種源庫保存之種源，其中高抗、抗、感、高感四等級各有 28、27、26 及 7 個品種(系)，發病指數最低爲 1.4%，最高 90.0%，屬高感等級的 7 個品種(系)皆爲甜椒類型，而高抗的 28 個品種(系)則皆爲辣椒類型。

關鍵詞：番椒、青枯病、抗病篩選

前　言

番椒爲茄科番椒屬之一年生或多年生作物，包括甜椒與辣椒。台灣總栽培面積約爲三千公頃[3]，主要產地有屏東、雲林、南投、嘉義、彰化、高雄、花蓮等七個縣市。辣椒喜溫暖、乾燥氣候，較番茄耐高溫，但不耐低溫，辣椒對溫度的適應性比甜椒廣。番椒根系不太發達，不耐淹水。番椒主要的病害有疫病、病毒病、炭疽病、細菌性斑點病、白粉病、青枯病、立枯病等，其中除疫病、病毒病與炭疽病外，最重要爲高溫期的青枯病與細菌性斑點病兩種細菌性病害危害嚴重。其中由青枯病菌(*Ralstonia solanacearum*, 原學名爲 *Pseudomonas solanacearum*) 引起的細菌性萎凋病(bacterial wilt)又稱青枯病，分佈遍及全世界，是熱帶及亞熱帶地區發生相當普遍且頗具威脅性的植物細菌性病害之一[1,5,7,8]，而台灣氣候高溫多濕，青枯病發生也相當普遍且嚴重，已有多種經濟作物受其危害，造成損失頗鉅[6]，尤其在夏季，青枯病常是茄科作物栽培上的限制因子之一。

青枯病菌是一種土壤傳播性病原菌，在植株上造成系統性感染，因此防治不易，目前防治青枯病的方法雖然很多，如種植抗病品種，使用健康種苗，施用土壤添加物，施用拮抗菌，輪作，田間衛

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生，改良耕作方式或土壤燻蒸等[1,6,7]；然而其中以採用抗病品種才是最根本的方法。目前已有抗青枯病之番椒品種(系)[4,9,10,11]，但有些抗病品種(系)，在某些地方卻表現不抗病，顯示抗病品種之選育與當地存在之青枯病菌菌系息息相關，因此國外選出抗病之品種(系)在臺灣栽植是否仍有抗病性，必需利用臺灣的菌系進一步篩選加以確認，以獲得適用於臺灣之品種(系)，本研究即以本所收集來自各地之番椒品種(系)及自留抗細菌性斑點病自交系爲材料，測試對臺灣青枯病菌株之抗感性，以供育種之參考。

材料與方法

供試番椒品種(系)來源

試驗的材料分爲二批，第一批含農試所 22 個抗細菌性斑點病自交系與臺灣 13 個一代雜交商業品種共計 35 個品種(系)，皆爲辣椒類型，品種(系)名稱、世代，如表 1 所示。第二批爲國家種原庫提供，共 88 個品種(系)包括辣椒與甜椒類型，皆源自亞洲蔬菜中心，其品種(系)名稱、來源及亞蔬編號如表 2 所示。

供試青枯病菌菌源之製備

將保存於蒸餾水中之 Ps95 菌株(中興大學徐世典教授提供，屬於 race1，biovar 4)劃線於 TTC 培養基上，於 30℃下培養 48 小時後，選取具病原性之典型菌落，再劃線於 PDA 培養基上，並於 30℃下培養 24 小時後懸浮於水中，以Spectrophotometer 在波長 A620nm 下，調整 O.D. 值至 0.3 作爲接種源，其濃度約爲 108 cfu/ml。

接種及調查方法：

所有供試植株均栽種於 35 孔穴之育苗盤中，每一品種(系)接種 10 株，於播種後 47 天之植株(約 5~6 葉)進行接種，接種時以剪刀沾取上述接種源，每沾一次接種源剪一植株，剪的部位爲供試植株完全展開之葉片(由上位葉往下數，約第三葉)，剪除面積約爲整個葉片之1/3，接種後置30℃生長箱中，21 天後調查發病情形。病害等級分爲 7級，分別爲

0：無病徵
1：接種葉黃化或莖壞疽
2：接種葉黃化且莖壞疽
3：1葉萎凋
4：2葉萎凋
5：3葉萎凋
6：＞3葉萎凋
7：萎凋死亡

發病級數再用於換算發病指數(disease index, DI)，

$$\text{發病指數}=\frac{N0\times0+N1\times1+N2\times2+N3\times3+N4\times4+N5\times5+N6\times6+N7\times7}{10\times7}\times100\%$$

其中 N0、N1、N2、N3、N4、N5、N6、N7分別代表 0、1、2、3、4、5、6、7 發病等級株數。發病指數低於 25% 判定爲高抗病，25-50%爲抗病，50-75%爲感病，75-100%爲高感病。另外，爲了解每個品種(係)間植株實際萎凋死亡情形，因此計算其萎凋比率(wilt percentage)，指供試植株中實際萎凋死亡株數所占比率。

結果與討論

第一批供試 35個品種(系)中，包含 22 個農試所自留品系與 13 個商業雜交品種，經接種後其發病指數如表3所示，最低爲 11.4%，最高爲100%，而高抗、抗、感、高感病等級各有 3、18、11、3 個品種(系)(表5)，顯示品種(系)間抗感性差異甚大。在供試的 13 個商業品種中，高抗、抗、感及高感病四等級的比率分別爲 0、38.5、38.5 及 23.1，僅‘生生199’、‘美香’、‘生生193’、‘生生194’及‘千里香’等 5 個品種達抗病的等級，其中‘生生193’爲目前主要之商業品種，而‘美香’及‘生生194’在先前試驗顯示爲抗細菌性斑點病品種[2]，因此這些同時抗青枯病與細菌性斑點病之品種，除了具有直接應用的價值外，且可從其後裔選拔純化同時抗兩種病害的自交系。在 35個供試品系中高感病等級的‘長香’、‘新香’、‘生生197’皆爲商業品種，其中‘新香’10 株接種後全部萎凋死亡，可做爲日後接種試驗的感病對照。供試商業品種中一代交配種的生生194(Avon Eg)接種後10株中雖有一株萎凋，但有三株僅接種葉黃化，顯示同一品種不同植株間對青枯病之反應有所差異，亦即抗性呈分離較大狀態，所以從其中可能可以選拔出抗病株並加以純化；而供試商業品種中一代交配種生生199(Smatra)有六株接種葉黃化與莖壞疽，僅一株出現 二個葉片萎凋，顯示其抗性較整齊。

供試 22 個自留六代的自交系中，'4207-5-37-4-2-2-5'、'4207-5-37-4-1-2-3'與'4207-16-45-2-2-1-1'，達高抗等級，發病指數分別只有 11.4、18.6與 24.3，而且這三個品系對細菌性斑點病亦具抗性[2]。自留品系在高抗、抗、感及高感四等級的比率分別佔13.6、59.1、27.3 及 0%。高抗與抗病的比率合計超過72.8%，遠高於商業品種的 38.5%，而且自留品系中沒有高感病品系，推測自留品系較商業品種抗病的可能原因爲自留品系多代在高溫期選拔，經田間自然發病環境壓力下篩選存活，雖未經人工接種選留，仍具一定程度抗性，其中以源自印度的‘4207’選留後裔最具抗性，在 12 個‘4207’選留後裔之品系中有三個屬於高抗，七個屬於抗病等級；而(4501-3×Shioushuei)後裔則多屬於感病等級，較‘4207’後裔感病。‘4501’爲由一代交配種‘百香’選拔之株系，‘百香’的發病指數爲 54.3%，而其雜交後裔發病指數介於 41.4與 72.9之間，六個品系平均發病指數爲 60.3，與‘百香’相差不大；另外，自留系中‘4207-5-37-4-1-2-2’雖有一株萎凋，但發病指數只有 28.6%，主要原因爲有一株無病徵與五株接種葉黃化，可能該品系對青枯病抗性仍呈分離，尚待進一步純化。

第二批國家種原庫的 88 個品種(系)之篩選結果如表4所示，發病指數最低爲‘Heart Shaped’僅 1.4%，而‘California Wonder 300’最高，其值爲 90.0%，顯示品種(系)間抗感性差異明顯。高抗的 28 個品系皆爲辣椒類型(表 5)，而高感的七個品系皆爲甜椒類型(表 5)，其中‘656 Calwonder’、‘Yolo Wonder’、‘California Wonder 300’皆爲親緣較近品種。門馬信二[4]測試不同來源甜椒及辣椒，同樣發現‘California Wonder’爲高感病品種，供試品種中有16個甜椒品種，其發病株率皆超過70.0%，屬較感病類型，但來自日本的六個甜椒品種(系)發病株率爲0，八個低於70.0%，而引自中國的八個甜椒品種(系)中，亦有二個低於 70%，顯示甜椒品系雖然一般較感病，但仍可找出抗病之品(種)系。同樣地，本研究之供試材料中編號爲67、70、77、92及93的甜椒品種屬抗病性，雖未達高抗等級，但接種植株均未出現萎凋死亡，可見這些甜椒類型的品系對青枯病仍具有某種程度之抗病性。甜椒類型發病指數最低者爲編號 78 的 34.3%，其中亦有一株無病徵及四株僅接種葉黃化，顯示在甜椒類型可能可經由選拔抗病單株留種純化，以提高對青枯病之抗性。

供試 88 個種源中屬於 *Capsicum annum* 近緣種的有三種，即 *C. baccatum*，*C. frutescens* 及 *C. chinense*，其中供試的 *C. frutescens* 二個品系皆屬高抗病性， *C. baccatum* 的三個品系分屬於高抗、抗及感病三個等級，而唯一的 *C. chinense* 品系則屬感病等級。門馬信二[4]在 48個近緣種測試中，低於或等於 20%發病株率的主要爲 *C. frutescens* 及 *C. baccatum*，而 *C. chinense* 較感病，發病率最低亦有 40%，

發病率比 *C. frutescens* 及 *C. baccatum* 爲高，顯示 *C. frutescens* 對青枯病有較高的抗性。本研究結果與門馬信二所得結果相似，但有關 *C. baccatum* 對青枯病的抗性則略有差異。

亞蔬中心進行青枯病的篩選時以 MC4 爲抗病對照[12]，本研究供試四個 MC4 品系，其發病等級有三個屬高抗，一個雖屬抗病等級，指數亦非常接近高抗等級。R1-26(17)在本所與亞蔬測試皆屬高抗，而 MC5 在二者測試皆略高於 MC4 與 R1-26(17)，顯示本所與亞蔬測試的相同品種部分，結果相符。門馬信二[4]調查的甜椒品系中，Ruby King 的萎凋比率高達 88.9%，而本研究中的發病指數亦高達 73.5%屬感病等級，二者結果相若。因此，利用臺灣分離之青枯病菌以剪葉方式篩選，雖然萎凋比率有所差異，但以發病指數來比較，顯示所得結果頗爲相似，可達到區別番椒品種(系)對青枯病抗性之差異，進而作爲選拔抗感病性的指標。

誌 謝

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表1. 供試辣椒農試所自留品系及臺灣商業品種之名稱、來源及世代

Table 1. Name, origin and generation of the tested TARI inbreeding lines and local commercial cultivars of chilli

Code	Line (cultivar)	Origin	Generation
001	955-1-19-4-1-5-4	TARI	S6
002	4207-5-37-4-1-2-2	TARI	S6
003	4207-5-37-4-1-2-3	TARI	S6
004	4207-5-37-4-1-4-5	TARI	S6
005	4207-5-37-4-2-2-5	TARI	S6
006	4207-5-37-4-2-3-3	TARI	S6
007	4207-5-37-4-3-1-3	TARI	S6
008	4207-5-37-4-3-1-5	TARI	S6
009	4207-5-37-4-3-3-3	TARI	S6
010	4207-16-28-5-3-1-1	TARI	S6
011	4207-16-45-2-2-1-1	TARI	S6
012	4207-16-45-2-3-1-5	TARI	S6
013	4207-16-45-2-3-2-4	TARI	S6
014	4446-OP-6-2-2-1-7	TARI	S5
015	4446-OP-6-2-2-5	TARI	S4
016	Shioushuei-OP-2-3-2-1-8	TARI	S5
017	(4501-3 Shioushuei)-5-1-2-5	TARI	F4
018	(4501-3 Shioushuei)-5-2-1-1	TARI	F4
019	(4501-3 Shioushuei)-5-3-1-3	TARI	F4
020	(4501-3×Shioushuei)-5-5-1-2	TARI	F4
021	(4501-3×Shioushuei)-5-5-3-5	TARI	F4
022	(4501-3×Shioushuei)-5-5-4-9	TARI	F4
023	Ever Flavor(千里香)	Known You Seed Co.	F1
024	Hot Beauty(美香)	Known You Seed Co.	F1
025	Stars(群星)	Known You Seed Co.	F1
026	Long Chili(長香)	Known You Seed Co.	F1
027	Golden Heat(金香)	Known You Seed Co.	F1
028	Chain Fair(千惠)	Known You Seed Co.	F1
029	Hero(英雄)	Known You Seed Co.	F1
030	Passion(百香)	Known You Seed Co.	F1
031	New Comer(新香)	Known You Seed Co.	F1
032	Delicacy(生生193)	Evergrow Seed Co.	F1
033	Avon Eg(生生194)	Evergrow Seed Co.	F1
034	Hungariana(生生197)	Evergrow Seed Co.	F1
035	Smatra(生生199)	Evergrow Seed Co.	F1

表2. 供試辣椒農試所自留品系及臺灣商業品種之名稱、來源及世代

Table 2. Name, origin and generation of the tested TARI inbreeding lines and local commercial cultivars of chilli

Code	Line (cultivar)	Origin	AVRDC Code
036	CATIE 7798	Costa Rica	C00085
037	UNNAMED	Phillippines	C00495
038	SERRANO CHILI	U.S.A	C00517
039	OHYATSUBUSA	Japan	C00834
040	PEPPER(*Capsicum baccatum*)	United Kindom	C00948
041	PEPPER	Honduras	C01720
042	NUM-59 R.B.-L.G.G	Honduras	C00645-1
043	80015	Ethiopia	C00665-1
044	Pepper	Turkey	C00300-1
045	FARMERS NEWCOMER	Taiwan	C00001
046	PASSION	Taiwan	C00005
047	YOUNG CHIAO CHIAO	Taiwan	C00006
048	672 HUNGARIAN WAX	U.S.A	C00011
049	TWIST GREEN	Korea	C00019
050	CH172-VERDE	Guatemaia	C00042-1
051	CATIE 7201-1-3-4(*Capsicum baccatum*)	Costa Rica	C00044
052	CATIE 10916-2-3-4-5-6	Costa Rica	00055
053	CATIE 7802	Costa Rica	C00077
054	CATIE 10994-2-3-4-5	Costa Rica	C00084
055	CATIE 10666-2-3-6	Costa Rica	C00086
056	CATIE 9095-1-2-3-5-6	Costa Rica	C00087
057	THAILAND 84-1	Thailand	C00098
058	MC4	Malaysia	C00104
059	MC4	Malaysia	C00104-2
060	MC4	Malaysia	C00104-3
061	MC4	Malaysia	C00104-7
062	MC5	Malaysia	C00105-3
063	PEPPER	Malaysia	C00105-5
064	NEW STAR	Taiwan	C00113
065	RUBY KING	Taiwan	C00116-2
066	BRUINSMA WONDER	Netherlands	C00129-5
067	GYPSY	U.S.A	C00131
068	656 CALWONDER	U.S.A	C00152
069	671 HYBELLE	U.S.A	C00153-1

續表2

Code	Line (cultivar)	Origin	AVRDC Code
070	673 LADY BELL	U.S.A	C00154
071	673 LADY BELL	U.S.A	C00154-1
072	YOLO WONDERL	U.S.A	C00157
073	YOLO WONDER L	U.S.A	C00157-3
074	YOLO WONDER B	U.S.A	C00159-2
075	CALIFORNIA WONDER 300(*TMR*)	U.S.A	C00161-3
076	PEPPER	U.S.A	C00196-1
077	SWEET BANANA	U.S.A	C00200-1B
078	SWEET BANANA	U.S.A	C00200-2
079	PEPPER	U.S.A	C00222
080	PEPPER	India	C00222-1
081	PEPPER	Mexico	C00225-1C
082	AGRONOMICO NO.8	U.S.A	C00227-1
083	PEPPER	U.S.A	C00229
084	PERENNIAL HDV	France	C00265-1
085	BASTIDON HDV	France	C00267
086	SERRAND 1534 PAUL SMITH'S	U.S.A	C00268
087	PEPPERONCINI		C00274
088	SERRAHO CHILI PVYRES	Netherlands	C00280
089	HAD 248	France	C00284
090	PEPPER	Turkey	C00296
091	PEPPER	Turkey	C00297
092	PEPPER	Turkey	C00297-B
093	PEPPER	Turkey	C00297-C
094	PEPPER	Turkey	C00299
095	PI152225(Capsicum chinense)	Peru	C00303
096	TABASCO(Capsicum frutescens)		C00306
097	UNKNOWN(Capsicum frutescens)		C00309
098	UNKNOWN	Taiwan	C00311
099	PEPPER(Capsicum baccatum)	Ecuador	C00313
100	U 276	Hungary	C00320
101	DELGADO	Netherlands	C00322
102	K5	Malaysia	C00325
103	VAR 6-1	Malaysia	C00326
104	LOCAL MEDIUM LONG	Malaysia	C00327
105	PJ	Malaysia	C00328

續表2

Code	Line (cultivar)	Origin	AVRDC Code
106	CILI PUTIH KELANTAN	Malaysia	C00330
107	BUKIT GAMBIR	Malaysia	C00311
108	BUKIT GAMBIR	Malaysia	C00331-1
109	B18 PUCHONG	Malaysia	C00332
110	CP NO.6(CILI PADI)	Malaysia	C00333
111	ACC.MED LONG	Malaysia	C00335
112	ACC.45 IPCH3	Malaysia	C00336
113	ASSORTED RED	Malaysia	C00338
114	HEART SHAPED	Malaysia	C00339
115	CANAPE	Hungary	C00342
116	QIEI MEN	China	C00344
117	K1	Malaysia	C00350
118	K2	Malaysia	C00351
119	R1-22(19)	Malaysia	C00369
120	RI-2(20)	Malaysia	C00370
121	RI-26(17)	Malaysia	C00373
122	RI-35(4)	Malaysia	C00375
123	NO.79	Malaysia	C00377

表 3. 農試所自留辣椒品系及台灣商業品種接種青枯病菌後之植株萎凋率、發病指數與抗病等級

Table 3. The wilt percentage, disease index(DI) and resistance level of TARI inbreeding lines and local commercial cultivars of chilli to bacterial wilt caused by *R. solanacearum*

Code	Variety (line)	Wilt(%)	DI(%)	Resistance level
5	4207-5-37-4-2-2-5	0%	11.4%	Highly resistant
3	4207-5-37-4-1-2-3	0%	18.6%	Highly resistant
11	4207-16-45-2-2-1-1	0%	24.3%	Highly resistant
1	955-1-19-4-1-5-1	0%	28.6%	Resistant
2	4207-5-37-4-1-2-2	10%	28.6%	Resistant
12	4207-16-45-2-3-1-5	0%	30.0%	Resistant
4	4207-5-37-4-1-4-5	0%	31.4%	Resistant
35	Smatra(生生199)	0%	31.4%	Resistant
13	4207-16-45-2-3-2-4	0%	34.3%	Resistant
14	4446-OP-6-2-2-1-7	0%	34.3%	Resistant
24	Hot Beauty(美香)	0%	34.3%	Resistant
32	Delicacy(生生193)	0%	34.3%	Resistant
15	4446-OP-6-2-2-5	0%	35.7%	Resistant
33	Avon Eg(生生194)	10%	37.1%	Resistant
10	4207-16-28-5-3-1-1	0%	40.0%	Resistant

續表3

Code	Variety (line)	Wilt(%)	DI(%)	Resistance level
19	(4501-3 Shioushuei)-5-3-1-3	10%	41.4%	Resistant
20	(4501-3 Shioushuei)-5-5-1-2	10%	45.7%	Resistant
9	4207-5-37-4-3-3-3	10%	47.1%	Resistant
16	Shioushuei-OP-2-3-2-1-8	0%	47.1%	Resistant
8	4207-5-37-4-3-1-5	10%	48.6%	Resistant
23	Ever Flavor(千里香)	20%	48.6%	Resistant
7	4207-5-37-4-3-1-3	10%	51.4%	Susceptible
27	Golden Heat(金香)	20%	54.3%	Susceptible
29	Hero(英雄)	30%	54.3%	Susceptible
30	Passion(百香)	20%	54.3%	Susceptible
6	4207-5-37-4-2-3-3	20%	55.7%	Susceptible
25	Stars(群星)	30%	60.0%	Susceptible
17	(4501-3×Shioushuei)-5-1-2-5	30%	65.7%	Susceptible
22	(4501-3×Shioushuei)-5-5-4-9	30%	66.1%	Susceptible
18	(4501-3×Shioushuei)-5-2-1-1	50%	70.0%	Susceptible
21	(4501-3×Shioushuei)-5-5-3-5	40%	72.9%	Susceptible
28	Chain Fair(千惠)	50%	74.3%	Susceptible
26	Long Chili(長香)	60%	80.0%	Highly susceptible
34	Hungariana(生生197)	70%	82.9%	Highly susceptible
31	New Comer(新香)	100%	100.0%	Highly susceptible

表 4. 國家種原庫番椒種原品種(系)之類型及接種青枯病菌後之萎凋率、發病指數與抗病等級

Table 4. The wilt percentage, disease index (DI) and resistance level of *Capsicum* spp.from National Office of Plant Germplasm to bacterial wilt caused by *R. solanacearum*

Code	Variety (line)	Type	Wilt(%)	DI(%)	Resistant level
114	HEART SHAPED	Chilli	0%	1.4%	Highly resistant
104	LOCAL MEDIUM LONG	Chilli	0%	4.3%	Highly resistant
56	CATIE 9095-1-2-3-5-6	Chilli	0%	5.7%	Highly resistant
97	UNKNOWN(*Capsicum frutescens*)	Chilli	0%	5.7%	Highly resistant
54	CATIE 10994-2-3-4-5	Chilli	0%	7.1%	Highly resistant
57	THAILAND 84-1	Chilli	0%	8.6%	Highly resistant
52	CATIE 10916-2-3-4-5-6	Chilli	0%	10.0%	Highly resistant
63	PEPPER	Chilli	0%	10.0%	Highly resistant
42	NUM-59 R.B.-L.G.G	Chilli	0%	11.4%	Highly resistant
96	TABASCO(*Capsicum frutescens*)	Chilli	0%	14.3%	Highly resistant
106	CILI PUTIH KELANTAN	Chilli	0%	15.7%	Highly resistant

續表4

Code	Variety (line)	Type	Wilt(%)	DI(%)	Resistant level
111	ACC.MED LONG	Chilli	0%	15.7%	Highly resistan
59	MC 4	Chilli	0%	17.1%	Highly resistan
102	K5	Chilli	0%	20.0%	Highly resistan
46	PASSION	Chilli	0%	21.4%	Highly resistant
51	CATIE 7201-1-3-4(*Capsicum baccatum*)	Chilli	10%	21.4%	Highly resistant
55	CATIE 10666-2-3-6	Chilli	0%	21.4%	Highly resistant
79	PEPPER	Chilli	0%	21.4%	Highly resistant
117	K1	Chilli	0%	21.4%	Highly resistant
118	K2	Chilli	0%	21.4%	Highly resistant
119	R1-22(19)	Chilli	0%	21.4%	Highly resistant
41	PEPPER	Chilli	0%	22.9%	Highly resistant
49	TWIST GREEN	Chilli	0%	22.9%	Highly resistant
120	R1-22(20)	Chilli	0%	22.9%	Highly resistant
122	R1-35(4)	Chilli	0%	22.9%	Highly resistant
60	MC 4	Chilli	0%	24.3%	Highly resistant
109	B18 PUCHONG	Chilli	0%	24.3%	Highly resistant
121	R1-26(17)	Chilli	0%	24.3%	Highly resistant
103	VAR 6-1	Chilli	0%	25.7%	Resistant
61	MC 4	Chilli	0%	26.8%	Resistant
123	NO.79	Chilli	0%	27.1%	Resistant
58	MC 4	Chilli	0%	28.6%	Resistant
108	BUKIT GAMBIR	Chilli	0%	28.6%	Resistant
36	CATIE 7798	Chilli	0%	30.0%	Resistant
43	80015	Chilli	0%	30.0%	Resistant
53	CATIE 7802	Chilli	0%	30.0%	Resistant
110	CP NO.6(CILI PADI)	Chilli	0%	30.0%	Resistant
62	MC 5	Chilli	0%	31.4%	Resistant
47	YOUNG CHIAO CHIAO	Chilli	0%	34.3%	Resistant
78	SWEET BANANA	Sweet	10%	34.3%	Resistant
112	ACC.45 IPCH3	Chilli	0%	34.9%	Resistant
83	PEPPER	Chilli	0%	35.7%	Resistant
86	SERRANO 1534 PAUL SMITH'S	Chilli	0%	36.5%	Resistant
99	PEPPER(Capsicum baccatum)	Chilli	0%	36.5%	Resistant
37	UNNAMED	Chilli	0%	38.6%	Resistant
105	PJ	Chilli	0%	38.6%	Resistant

續表4

Code	Variety (line)	Type	Wilt(%)	DI(%)	Resistant level
85	BASTIDON HDV	Chilli	10%	40.0%	Resistant
89	HAD 248	Chilli	0%	40.0%	Resistant
38	SERRANO CHILI	Chilli	20%	41.4%	Resistant
81	PEPPER	Chilli	0%	42.9%	Resistant
100	U 276	Chilli	0%	45.7%	Resistant
94	PEPPER	Sweet	30%	46.0%	Resistant
107	BUKIT GAMBIR	Chilli	0%	46.0%	Resistant
50	CH172-VERDE	Chilli	0%	48.6%	Resistant
113	ASSORTED RED	Chilli	0%	48.6%	Resistant
73	YOLO WONDER L	Sweet	20%	51.4%	Susceptible
91	PEPPER	Chilli	10%	51.4%	Susceptible
92	PEPPER	Sweet	0%	52.9%	Susceptible
80	PEPPER	Chilli	0%	54.3%	Susceptible
70	673 LADY BELL	Sweet	0%	57.1%	Susceptible
76	PEPPER	Chilli	0%	57.1%	Susceptible
84	PERENNINL HDV	Chilli	0%	57.1%	Susceptible
88	SERRAHO CHILI PVYRES	Chilli	20%	57.1%	Susceptible
40	PEPPER(Capsicum accatum)	Chilli	0%	58.6%	Susceptible
93	PEPPER	Sweet	0%	58.6%	Susceptible
64	NEW STAR	Sweet	20%	60.0%	Susceptible
69	671 HYBELLE	Sweet	10%	60.0%	Susceptible
39	OHYATSUBUSA	Chilli	0%	62.9%	Susceptible
77	SWEET BANANA	Sweet	0%	62.9%	Susceptible
82	AGRONOMICO NO.8	Sweet	30%	62.9%	Susceptible
115	CANAPE	Chilli	20%	62.9%	Susceptible
67	GYPSY	Sweet	0%	64.3%	Susceptible
95	PI 152225(Capsicum chinese)	Chilli	20%	64.3%	Susceptible
87	PEPPERONCINI	Sweet	50%	67.1%	Susceptible
48	672 HUNGARIAN WAX	Chilli	0%	67.3%	Susceptible
98	UNKNOWN	Chilli	10%	68.6%	Susceptible
90	PEPPER	Chilli	0%	71.4%	Susceptible
45	FARMERS NEWCOMER	Chilli	60%	72.9%	Susceptible
74	YOLO WONDER B	Sweet	70%	72.9%	Susceptible
65	RUBY KING	Sweet	60%	73.5%	Susceptible
66	BRUINSMA WONDER	Sweet	50%	74.3%	Susceptible
68	656 CALWONDER	Sweet	60%	77.1%	Highly susceptible
72	YOLO WONDER L	Sweet	70%	79.6%	Highly susceptible
101	DELGADO	Sweet	70%	81.4%	Highly susceptible

續表4

Code	Variety (line)	Type	Wilt(%)	DI(%)	Resistant level
116	QIEI MEN	Sweet	60%	81.4%	Highly susceptible
44	PEPPER	Sweet	40%	84.3%	Highly susceptible
71	673 LADY BELL	Sweet	70%	85.7%	Highly susceptible
75	CALIFORNIA WONDER 300(*TMR*)	Sweet	80%	90.0%	Highly susceptible

表 5. 不同類型番椒品種(系)在抗青枯病篩選的四個抗病等級中之品種(系)數

Table 5. The number of four resistance levels of different types of *Capsicum* spp. to *R. solanacearum*

Resistance level	Experiment 1		Experiment 2	
	Chili type of local commercial cultivar	Chili type of TARI inbreeding line	Chili type of National germplasm	Sweet type of National germplasm
Highly Resistant	0	3	28	0
Resistant	5	13	25	2
Susceptible	5	6	13	13
Highly susceptible	3	0	0	7

Screening of Peppers for Resistance to Bacterial Wilt Caused by *Ralstonia solanacearum*[1]

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Summary

Two sets of pepper materials, totally 123 cultivars or lines, were screened for their resistance to bacterial wilt caused by *Ralstonia solanacearum* using a leaf-clip inoculation method. The first set of tested materials included 13 local commercial cultivars and 22 TARI inbreeding lines, which were all hot pepper type. Among them, the disease index of the lowest was 11.4% and the highest was 100%. The number of cultivars or lines rated as highly resistant, resistant, susceptible and highly susceptible were 2, 19, 11, and 3, respectively. The two highly resistant peppers were the inbreeding lines: '4207-5-37-4-2-2-5' and '4207-16-45-2-2-1-1', and the three highly susceptible peppers were all commercial varieties: 'Long Chili', 'New Comer', and 'Hungariana'. However, the commercial varieties, 'Smatra', 'Hot Beauty', 'Delicacy', 'Avon Eg', and 'Ever Flavor' showed resistance. The ratios of highly resistant, resistant, susceptible and highly susceptible among TARI inbreeding lines were 9.2, 63.6, 27.2, and 0%, respectively and the commercial varieties were 0, 38.5, 38.5, and 23%, respectively. This indicated that the TARI inbreeding lines were more resistant to bacterial wilt than the commercial varieties. The second set of tested materials were samples obtained from the Office of Plant Germplasm totally including 88 cultivars or lines of sweet and hot pepper types. Among these materials, the lowest disease index was 1.4% and the highest was 90.0%. The number of cultivars or lines rated as highly resistant, resistant, susceptible and highly susceptible were 28, 27, 26, and 7, respectively. The seven highly susceptible varieties(lines) were all sweet pepper type and the 28 highly resistant cultivars (lines) were all belonged to hot peppers.

Key words: *Capsicum* spp., bacterial wilt, resistance screening, *Ralstonia solanacearum*

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