

Supplementary Materials: Evolution of Asian Corn Borer Resistance to Bt Toxins used Singly or in Pairs

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Table S1. Resistance ratios (RRs) and their 95% confidence intervals (CIs) for five strains of *Ostrinia furnacalis* selected with Bt toxins singly or in pairs.

Three strains selected with a single toxin					Two strains selected with a pair of toxins										
Selected with		95% CI			Selected with		95% CI			Selected with		95% CI			
	Gen.	RR	Lower	Upper		Cry1Ab	Gen.	RR	Lower	Upper		Gen.	RR	Lower	Upper
Cry1Ab															
Cry1Ab	1	1.4	0.8	2.5	Cry1Ab	1	2.0	1.4	2.9	Cry1Ab	1	1.6	1.1	2.3	
	2	1.1	0.7	1.7	+ Cry1F	2	3.7	3.0	4.5	+Cry1Ie	2	1.6	1.2	2.2	
	3	0.9	0.6	1.5		3	3.3	2.6	4.1		3	1.9	1.4	2.5	
	4	3.9	2.4	6.4		4	3.8	2.9	5.0		4	3.0	2.4	3.8	
	5	4.7	3.5	6.3		5	2.7	2.0	3.7		5	3.0	2.2	4.1	
	6	5.8	4.5	7.5		6	7.8	5.8	10.6		6	7.6	5.7	10.1	
	7	13.2	10.1	17.2		7	17.9	13.6	23.6		7	15.6	11.0	22.0	
	8	18.5	14.9	23.0		8	17.6	13.6	22.8		8	14.7	10.7	20.2	
	9	23.4	18.2	30.0		9	11.2	8.8	14.3		9	24.3	18.2	32.6	
	10	23.6	17.2	31.3		10	12.5	9.0	17.4		10	29.8	21.1	42.2	
	11	32.0	24.3	42.2		11	32.1	24.6	42.0		11	44.6	33.2	59.8	
	12	38.8	30.8	48.9		12	35.2	27.1	45.7		12	53.8	42.2	68.7	
	13	33.1	22.9	47.8		13	36.8	28.9	46.9		13	64.6	51.2	81.5	
	14	28.2	22.6	35.2		14	32.5	23.4	45.1		14	60.4	46.7	78.5	
Cry1F															
Cry1F	1	1	0.8	1.3	Cry1Ab	1	1.5	1.1	2	Cry1F					
	2	1.5	1.1	2.0	+ Cry1F	2	2.0	1.5	2.8						
	3	1.4	1.1	1.8		3	1.8	1.4	2.4						
	4	2.6	1.8	3.9		4	5.8	4.5	7.4						
	5	59.0	44.7	77.9		5	45.4	28.8	71.6						
	6	557	419	740		6	240	167	344						
	7	>600				7	>600								
	9	>1300				9	-								
	10	>1250				10	-								
	11	>1250				11	>1250								
	12	>1250				12	-								

Table S2. LC₅₀s and their 95% fiducial limits (in µg toxin per g diet) for five strains of *Ostrinia furnacalis* selected with Bt toxins singly or in pairs

Three strains selected with a single toxin				Two strains selected with a pair of toxins							
Selected with	Gen.	n	LC50 (95% FL)*	Selected with	Gen.	n	LC50 (95% FL)	Selected with	Gen.	n	LC50 (95% FL)
Cry1Ab						Cry1Ab					
Cry1Ab	0	672	0.21 (0.16–0.27)	Cry1Ab	0	480	0.18 (0.14–0.22)	Cry1Ab	0	480	0.18 (0.14–0.22)
	1	720	0.27 (0.05–0.41)	+ Cry1F	1	480	0.39 (0.19–0.58)	+ Cry1Ie	1	480	0.30 (0.19–0.40)
	2	720	0.22 (0.13–0.35)		2	480	0.71 (0.59–0.81)		2	480	0.31 (0.21–0.42)
	3	720	0.17 (0.08–0.29)		3	384	0.64 (0.52–0.75)		3	384	0.37 (0.24–0.50)
	4	480	0.75 (0.48–1.42)		4	432	0.74 (0.58–0.92)		4	576	0.59 (0.49–0.70)
	5	480	0.90 (0.69–1.14)		5	576	0.52 (0.39–0.67)		5	528	0.58 (0.43–0.74)
	6	528	1.12 (0.89–1.37)		6	720	1.52 (1.15–1.94)		6	816	1.48 (1.15–1.87)
	7	480	2.57 (2.02–3.14)		7	624	3.48 (2.69–4.30)		7	624	3.02 (2.11–3.98)
	8	528	3.59 (3.07–4.21)		8	624	3.42 (2.74–4.18)		8	576	2.86 (2.12–3.73)
	9	576	4.55 (3.69–5.51)		9	480	2.18 (1.79–2.62)		9	528	4.72 (3.58–5.97)
	10	576	4.58 (3.52–5.72)		10	528	2.45 (1.77–3.12)		10	528	5.79 (4.01–7.66)
	11	576	6.21 (4.80–7.70)		11	576	6.23 (4.94–7.72)		11	624	8.65 (6.56–10.9)
	12	576	7.53 (6.32–9.01)		12	624	6.84 (5.39–8.31)		12	624	10.5 (8.44–13.3)
	13	672	6.10 (4.91–7.36)		13	624	7.14 (5.84–8.59)		13	672	12.5 (10.5–15.0)
	14	576	5.49 (4.42–6.80)		14	672	6.32 (4.61–8.26)		14	624	11.7 (9.38–14.3)
Cry1F						Cry1F					
Cry1F	0	720	0.54 (0.40–0.69)	Cry1Ab	0	576	0.54 (0.27–0.84)				
	1	720	0.80 (0.64–0.97)	+ Cry1F	1	432	1.15 (0.71–1.68)				
	2	720	1.16 (0.93–1.44)		2	480	1.61 (1.21–2.10)				
	3	720	1.07 (0.89–1.28)		3	384	1.45 (1.14–1.80)				
	4	480	2.09 (0.86–3.02)		4	576	4.57 (3.79–5.42)				
	5	528	48.2 (38.6–59.1)		5	672	36.1 (23.7–54.9)				
	6	672	442 (366–604)		6	672	190 (143–269)				
	7	96	>476 (7.5%)		7	96	> 476 (6.5%)				
	9	96	>1030 (48.4%)		9						
	10	96	>1000 (23.5%)		10						
	11	96	>1000 (35.7%)		11	96	> 1000 (47.3%)				
	12	96	>1000 (47.3%)		12						
	13	96	>1000 (27.9%)		13						
	14	96	>1000 (41.7%)		14	96	> 1000 (46.8%)				
Cry1Ie						Cry1Ie					

Cry1Ie	0	576	1.25 (1.07–1.42)	Cry1Ab	0	480	2.45 (1.73–3.35)
	1	576	1.55 (1.32–1.75)	+ Cry1Ie	1	480	6.27 (4.94–7.80)
	2	576	1.84 (1.61–2.05)		2	480	6.56 (4.52–8.52)
	3	480	2.19 (0.77–4.14)		3	384	5.78 (4.80–6.85)
	4	480	7.39 (5.72–9.32)		4	576	24.9 (18.9–35.1)
	5	480	133 (107–166)		5	672	207 (159–274)
	6	576	270 (198–397)		6	96	> 952 (12.9%)
	7	96	>952 (8.6%)		7	96	> 952 (14.1%)
	9	48	>1935 (10.4%)		9		
	10				10	48	>2020 (8.7%)
	12	48	>2480 (0.0%)		12		
	13				13	48	>2700 (4.2%)
	14	96	>2047 (0.0%)		14	48	>2680 (0.0%)

*When the highest concentration tested killed <50% of larvae, the LC₅₀ is listed as > the highest concentration tested, the percentage mortality at that concentration in parentheses (adjusted for control mortality), and n is the number of larvae tested at that concentration, for example, in generation 7 for the strain selected with Cry1F, 7.5% of larvae were killed by 476 µg Cry1F per g diet, the highest concentration tested.

Table S3. LC₅₀s and their 95% fiducial limits (in µg toxin per g diet) for the unselected susceptible S strain of *Ostrinia furnacalis*.

Replicate ^a	n	LC50 (95% FL)
Cry1Ab		
A	480	0.18 (0.14–0.22)
B	480	0.18 (0.14–0.22)
C	576	0.23 (0.17–0.30)
D	576	0.17 (0.14–0.21)
E	576	0.21 (0.17–0.25)
F	672	0.22 (0.14–0.30)
Pooled	3360	0.19 (0.16–0.23)
Cry1F		
A	576	0.54 (0.27–0.84)
B	480	1.00 (0.80–1.24)
C	576	1.17 (0.90–1.48)

D	576	0.60 (0.46–0.76)
E	624	0.75 (0.58–0.95)
F	672	0.74 (0.58–0.92)
Pooled	3504	0.79 (0.63–0.96)
Cry1Ie		
A	480	2.45 (1.73–3.35)
B	384	2.62 (2.22–3.06)
C	528	2.68 (2.15–3.26)
D	528	2.01 (1.60–2.47)
E	624	1.96 (1.52–2.45)
F	528	2.21 (1.74–2.77)
G	576	2.34 (1.87–2.88)
Pooled	3648	2.43 (2.07–2.79)

^aReplicates were done throughout the 14 generations of the selection experiment, roughly every other generation.