Q and B biotypes– distribution, crop-relation, and their relevance to insecticide resistance

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biotype B

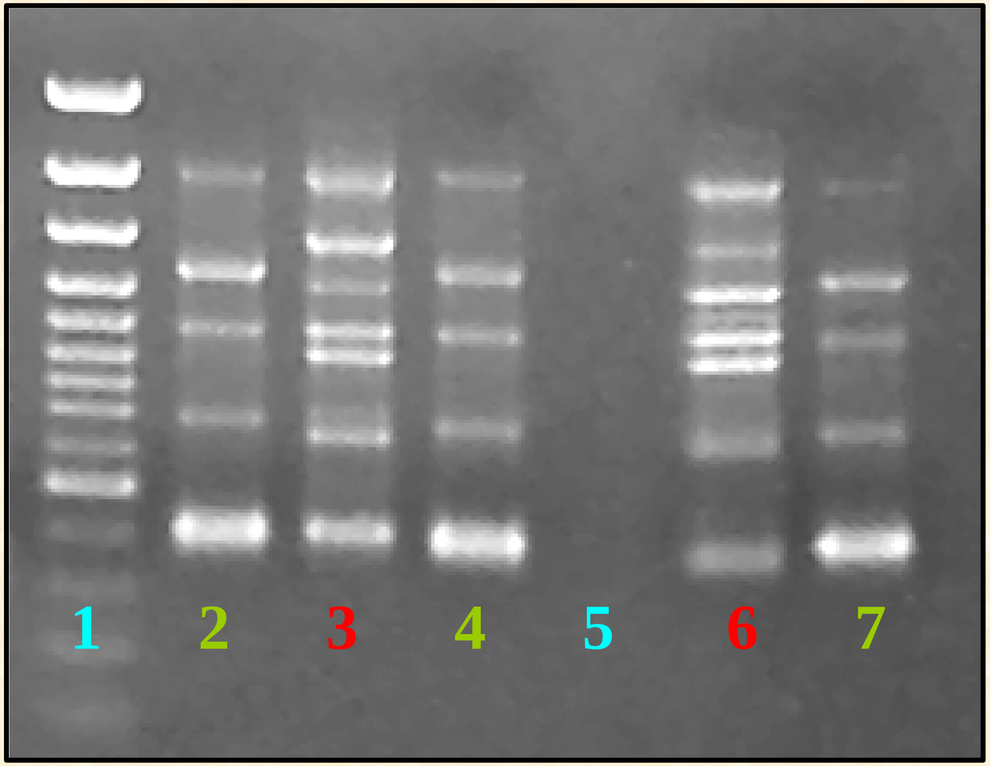
biotype Q

Two biotypes of *B. tabaci* have been identified in Israel:

B - (early 1990’s)

Q - (2000)

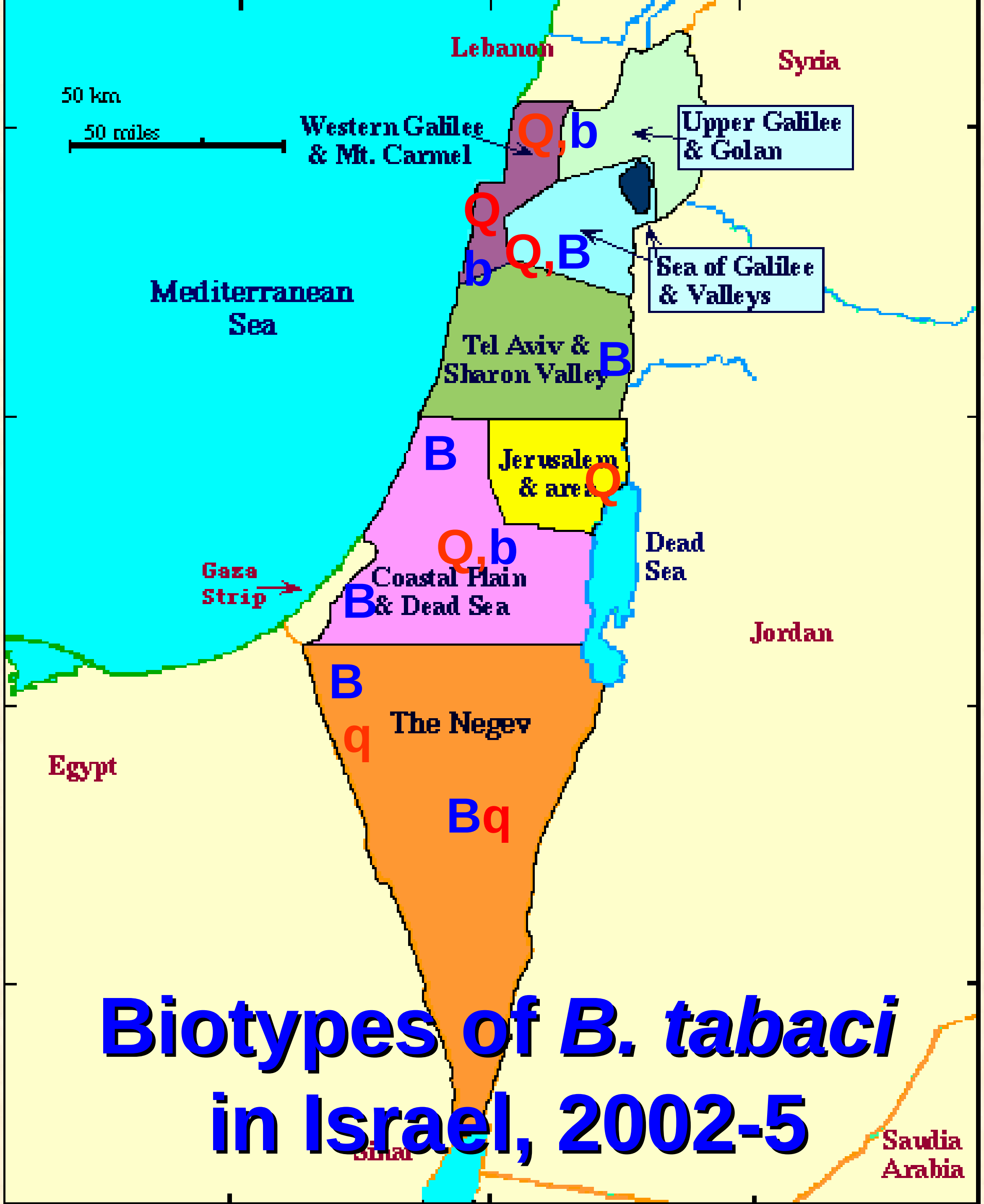
RAPD-PCR products of various *Bemisia tabaci* strains from Israel



Lane 1- DNA ladder; 5- a sample without DNA

Lanes 2, 4, 7- samples from Sde-Eliyahu, w-Negev & standard B

Lanes 3, 6 – samples from the Carmel Coast & standard Q

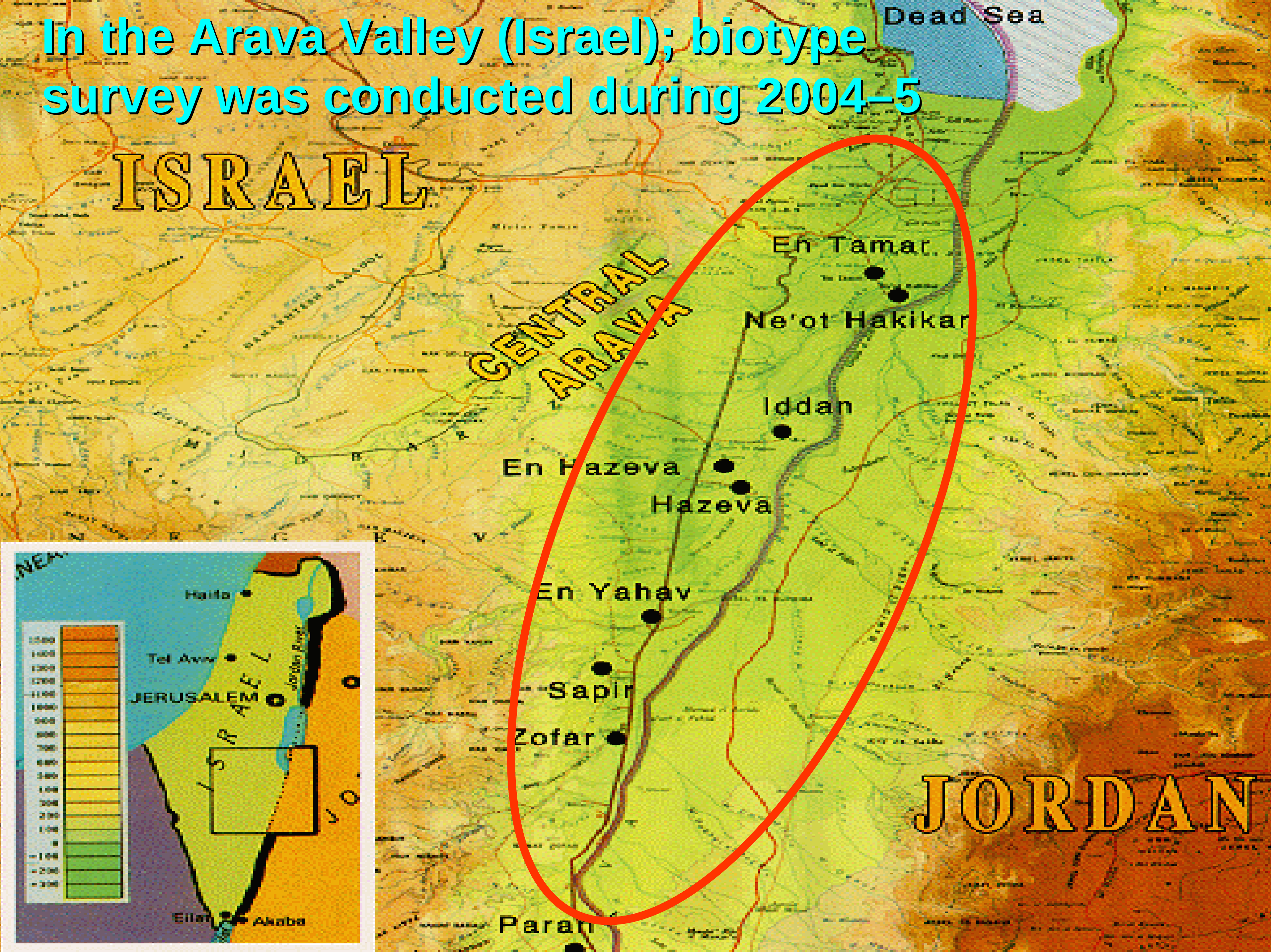


Biotypes of *B. tabaci* in Israel, 2002-5

Crossing studies, Q/B (field strains)

Parents		Offspring		
Females 20	Males 40	Females	Males	Sex ratio Female: Male
Negev (B)	Negev (B)	360	206	1.0:0.7
Negev (B)	Arava (Q)	0	245	0.0:1.0
Arava (Q)	Arava (Q)	458	316	1.0:0.7
Arava (Q)	Negev (B)	6?	503	0.01:1.0

In the Arava Valley (Israel); biotype survey was conducted during 2004–5

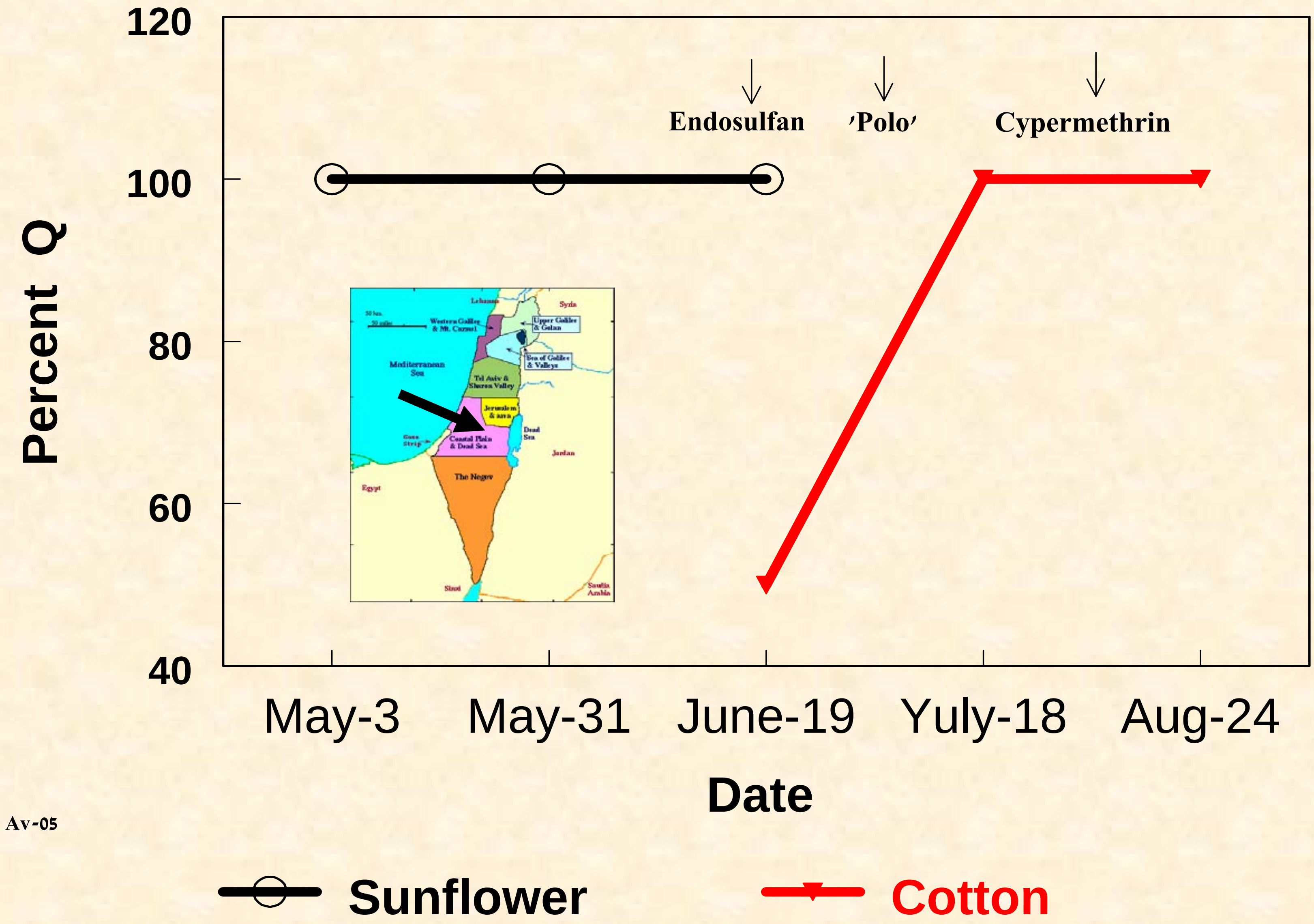


Organic vs. conventional crops

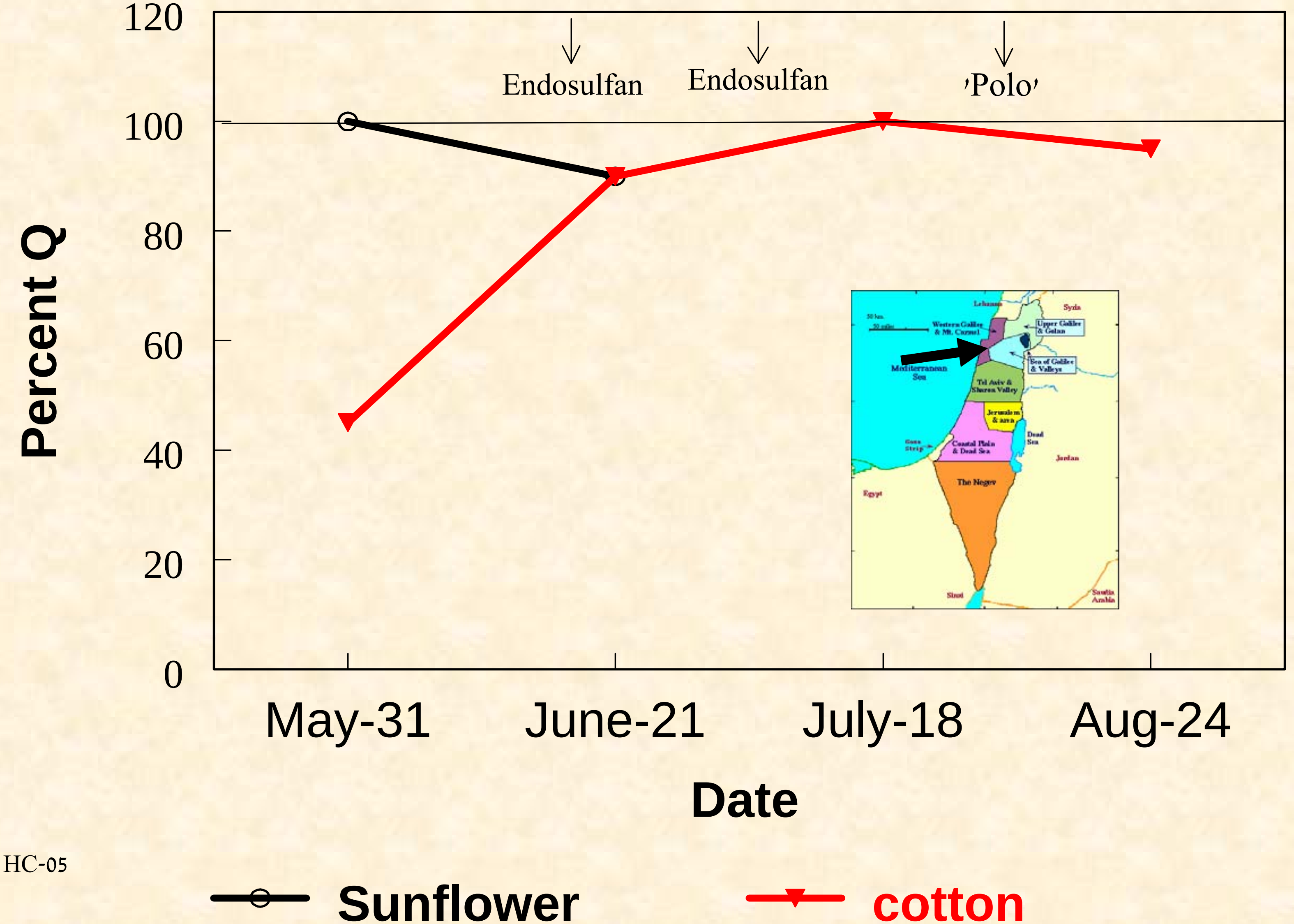
- In the Arava Valley (Israel); biotype survey was conducted during 2004 – 2005.

- **Greenhouse organic peppers, cucumbers and melons – B.**
- **Conventional greenhouses – Mostly Q**

Proportion of *B. tabaci* biotype Q and B sampled from sunflower and cotton fields during 2005 cotton season in the Ayalon Valley, Israel



Proportion of *B. tabaci* biotype Q and B sampled from sunflower and cotton fields during 2005 cotton season in the Carmel Coast, Israel



HC-05

Biotype tolerance to insecticides affects their field composition

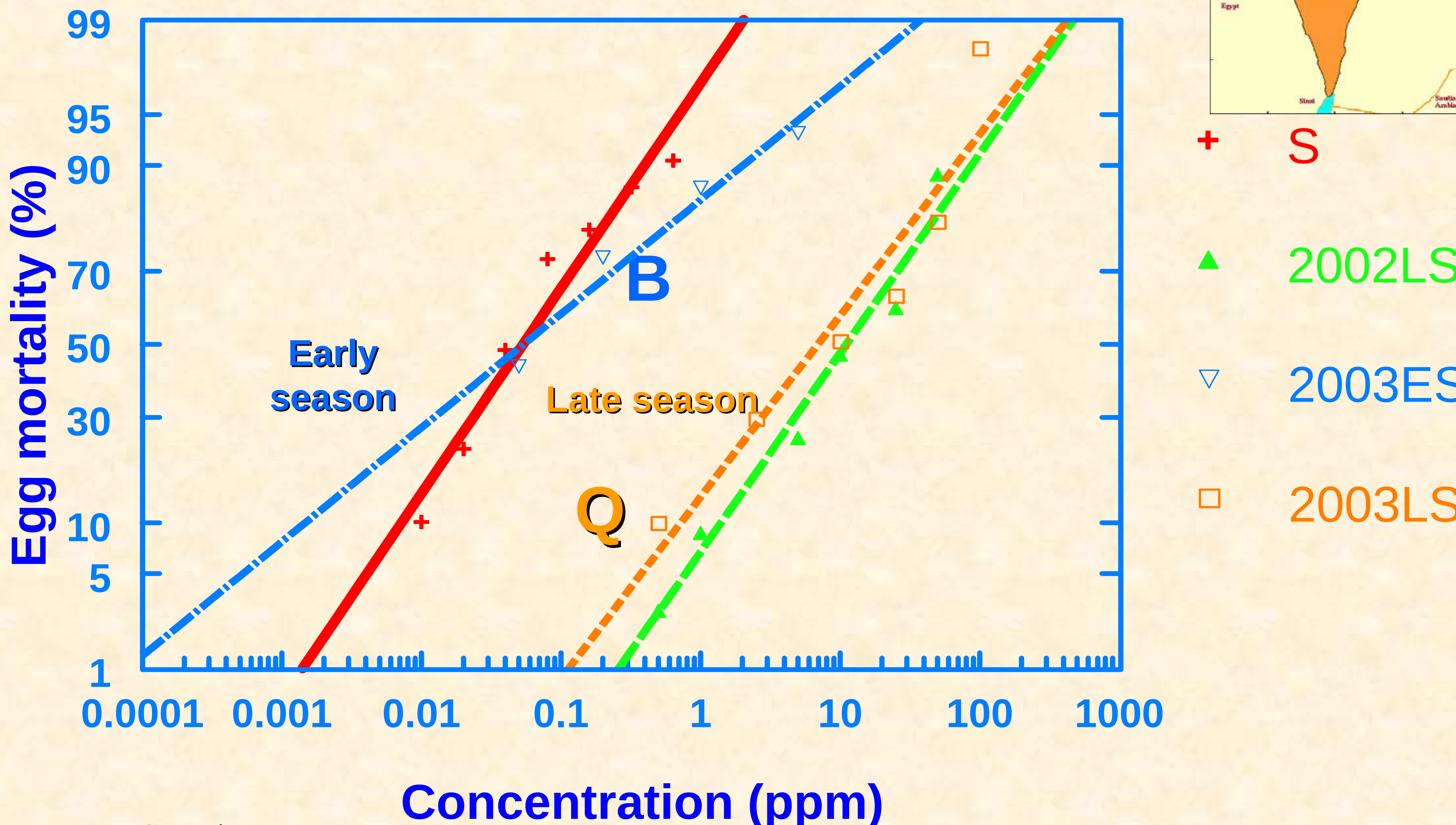
A ⟷ B

B ⟷ Q

Various populations of *Bemisia tabaci* collected in Israel, their biotype definition and resistance to pyriproxyfen

Strain	Collection date	Location	Biotype	Resistance (RR)
*S	1987	Tzor'a	B	1
Yesha-99	1999	W- Negev	B	2
BD-00	2000	Bet Dagan	B	4
Negev-00	2000	W- Negev	B	0.4
BS-00	2000	Bet She'an	B	9
*Pyri-R	1991	GH, W- Negev	Q	1,200
HC-00	2000	Carmel Coast	Q	637
AV-99	1999	Ayalon Valley	Q>b	167
AV-00	2000	Ayalon Valley	Q>b	81
W-Gal	2000	W- Galilee	Q>b	25

Monitoring pyriproxyfen resistance, Carmel Coast 2002-3



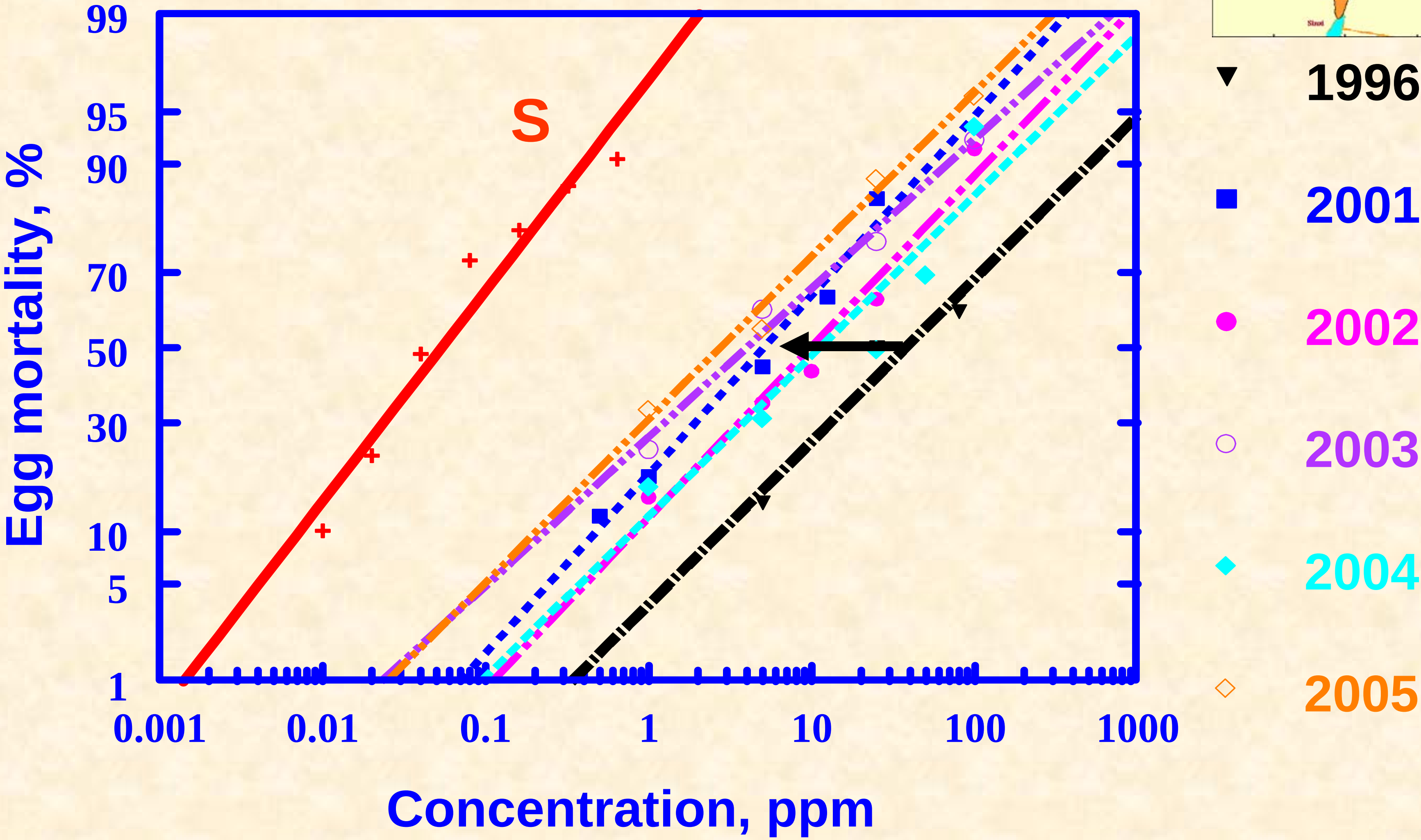
HC-03-tig

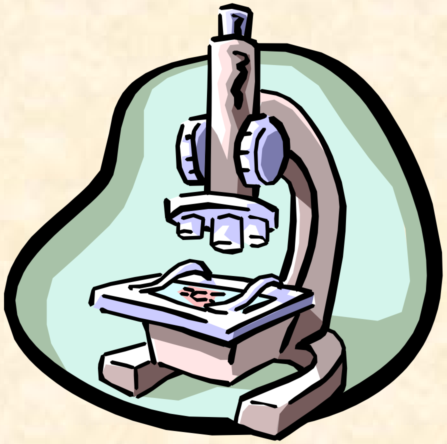
Resistance to Pyriproxyfen and biotype Q

- ✓ In areas where the use of pyriproxyfen ceased, resistance levels declined to some extent,

  while…
- ✓ Level of susceptibility was restored completely in the lab (gen. 15-20).
- ✓ Biotype-related resistance?

Monitoring Pyriproxyfen Resistance, Ayalon Valley, Israel

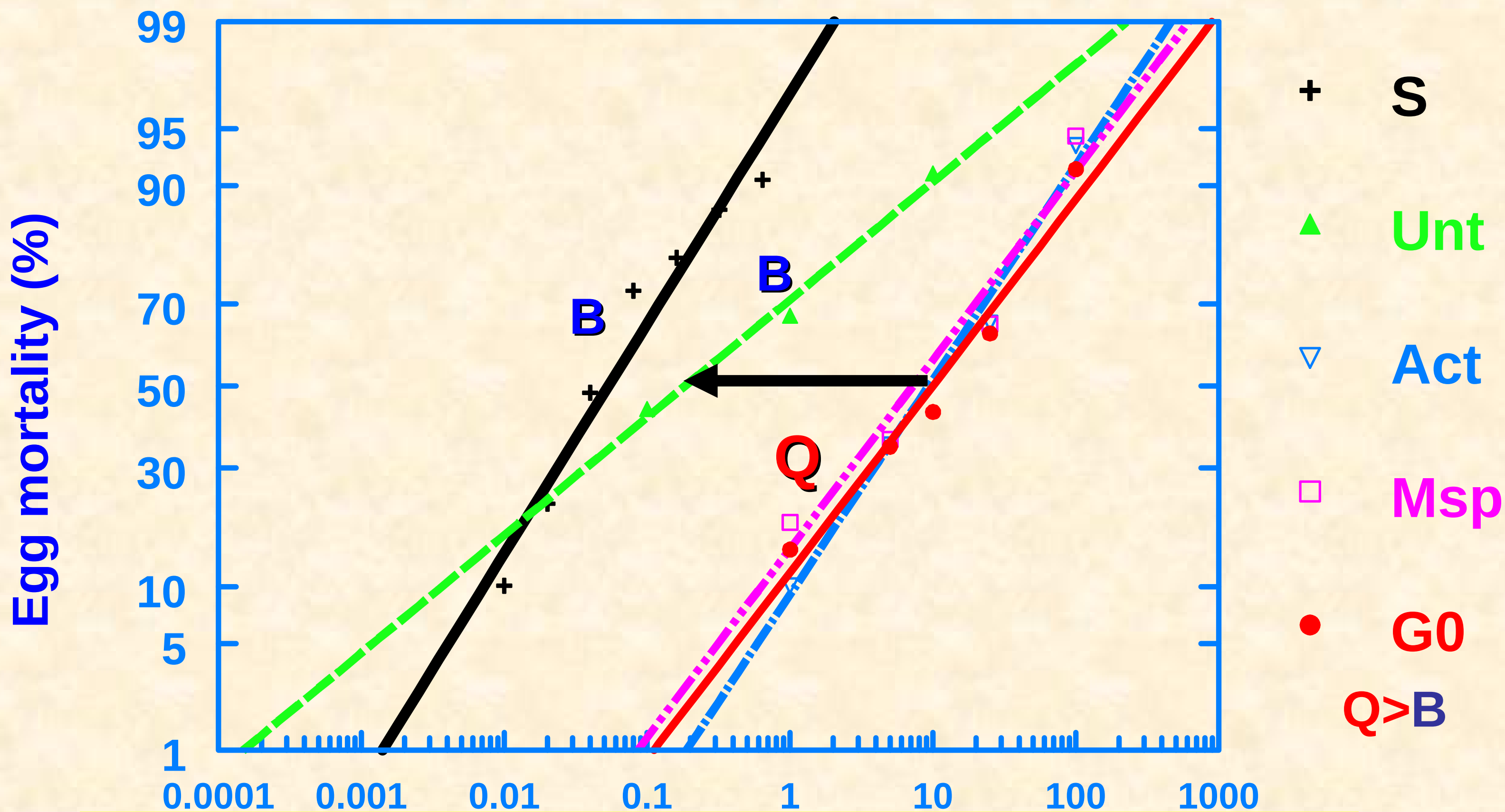




Lab assays

Susceptibility of *B. tabaci* strain (AV-02) to pyriproxyfen

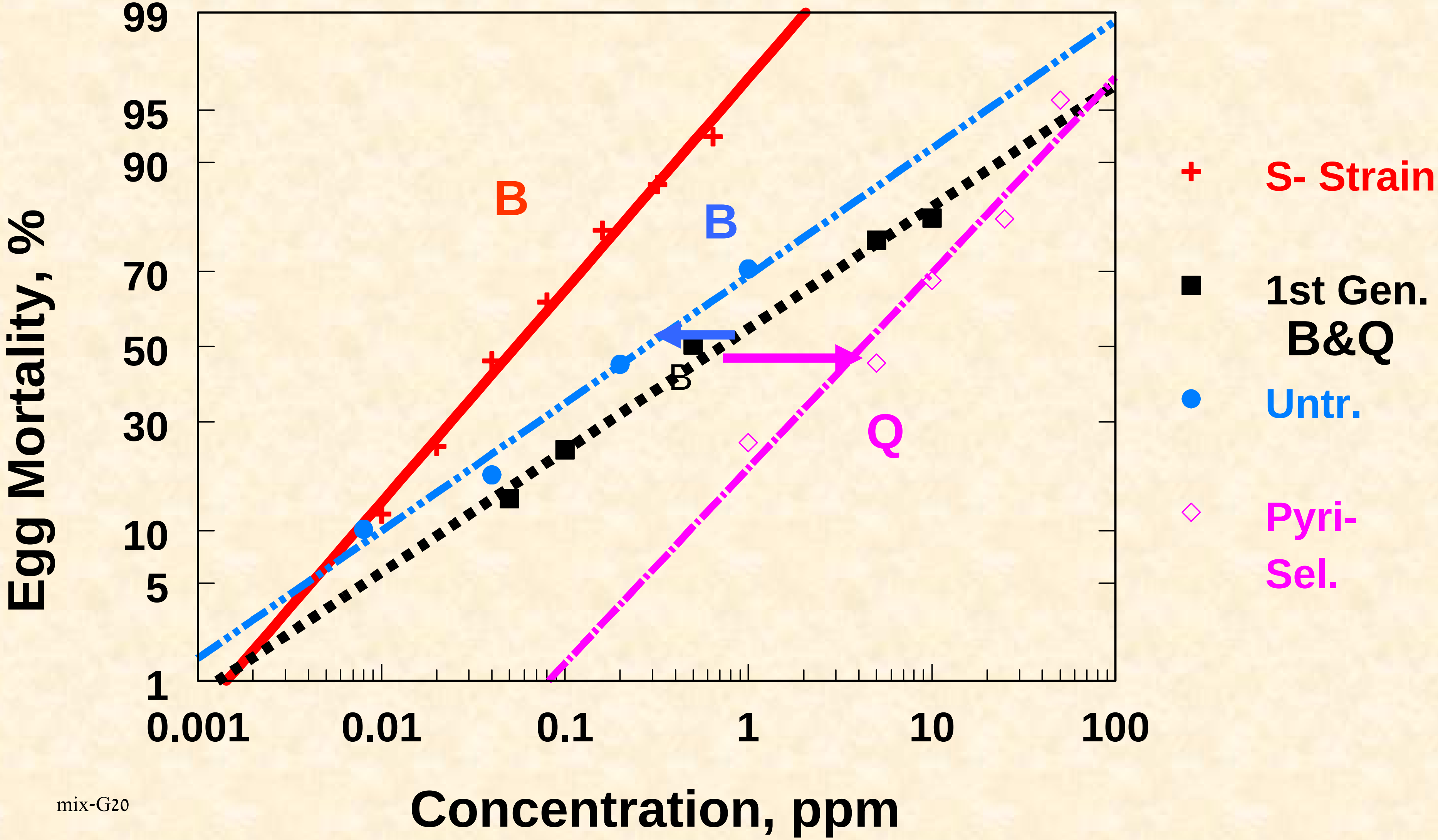
Laboratory conditions (15th generations)



Tiger-Se

S=susceptible ;G0 =the original strain; Unt=untreated;
Act=selection to Actara (thiamethoxam);
Msp=selection to Mospilan (acetamiprid)

Mix of Q&B (1:1, with similar R) maintained for 20 generations; partly pressurized with pyriproxyfen; another part - kept untreated



Proportion of *B. tabaci* biotypes throughout the generations

Generation	untreated	Pyri-selection
G-0	1B:1Q	1B:1Q
G-4	B	1B:1Q
G-8	B	Q>B
G-12	B	Q
G-16	B	Q
G-20	B	Q

Interaction of *B. tabaci* Biotype

1. Both the B and Q biotypes are present in Israel
2. Field populations may consist of a mixture of biotypes
3. Reproductive incompatibility maintains their genetic isolation
4. A possible link exists between *B. tabaci* biotypes and insecticide resistance
5. Tolerance of Q-type to pyriproxyfen, neonicotinoids and other new insecticides (?)
6. Without exposure to insecticides – higher fitness to “B” (?)
7. Insecticide applications select for Q-type.

We can surmise the following scenario

Appearance of Q biotype accompanies resistance to pyriproxyfen and/or neonicotinoids.

Treatments in accordance with IRM programs moderate selection for resistance to those insecticides and concurrently reduce the appearance of the Q-type.

Reuse of the above insecticides against *B. tabaci* may increase occurrence of the Q-type and development of resistance to one or another group of insecticides.

(Selection to insecticides in B biotype of *B. tabaci* is feasible, but it is probably slower than in the Q type).

Unsolved questions

1. Does B-type have higher fitness than Q-type (is it more competitive)?
2. Why does “B” take over “Q” after several generations under lab conditions?
3. Reproductive barrier: attraction, mating behavior, fertility, symbiont related?

Thanks for your attention