Olive Fruit Fly Update

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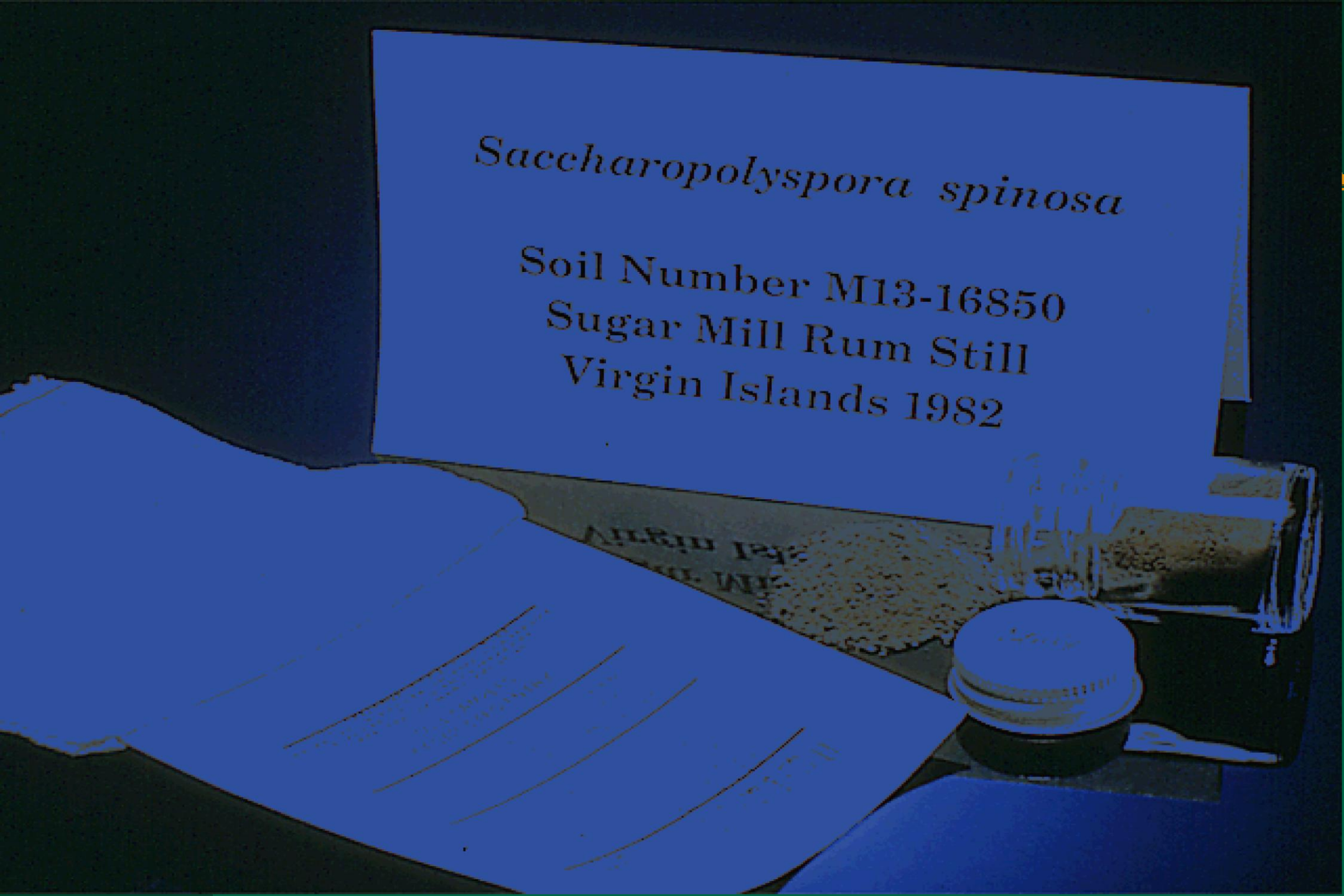
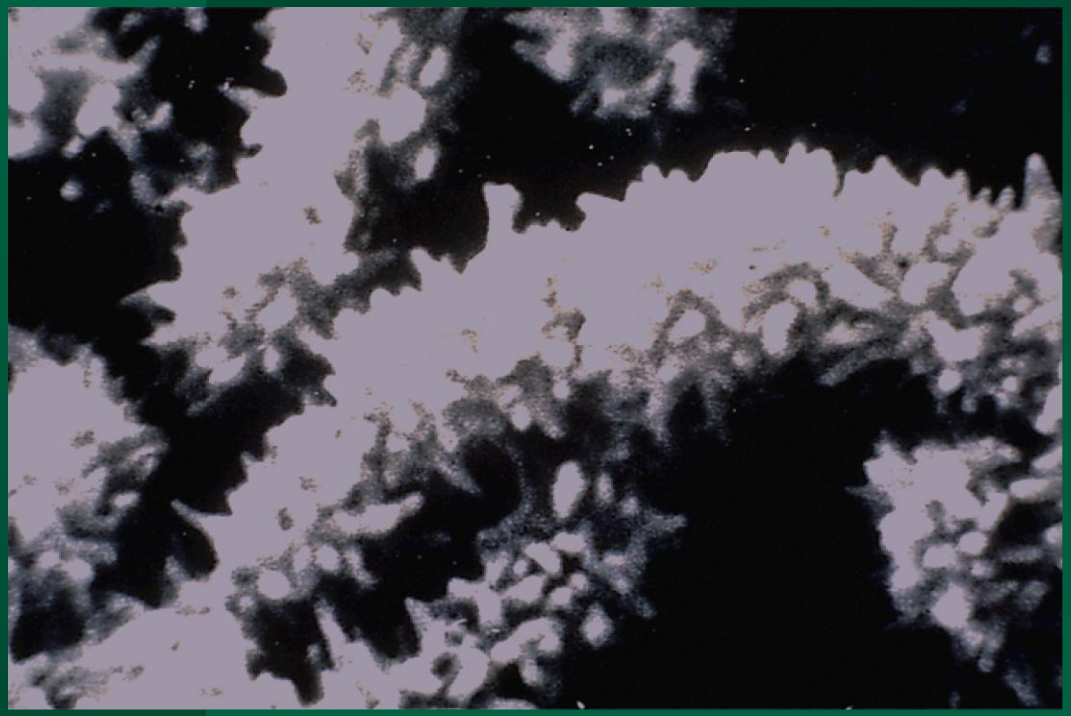
Outline

- GF-120 Efficacy
- Danitol Efficacy
- OLFF Resistance to Spinosad
- Origins of California OLFF


Saccharopolyspora spinosa
Soil Number M13-16850
Sugar Mill Rum Still
Virgin Islands 1982

Saccharopolyspora spinosa



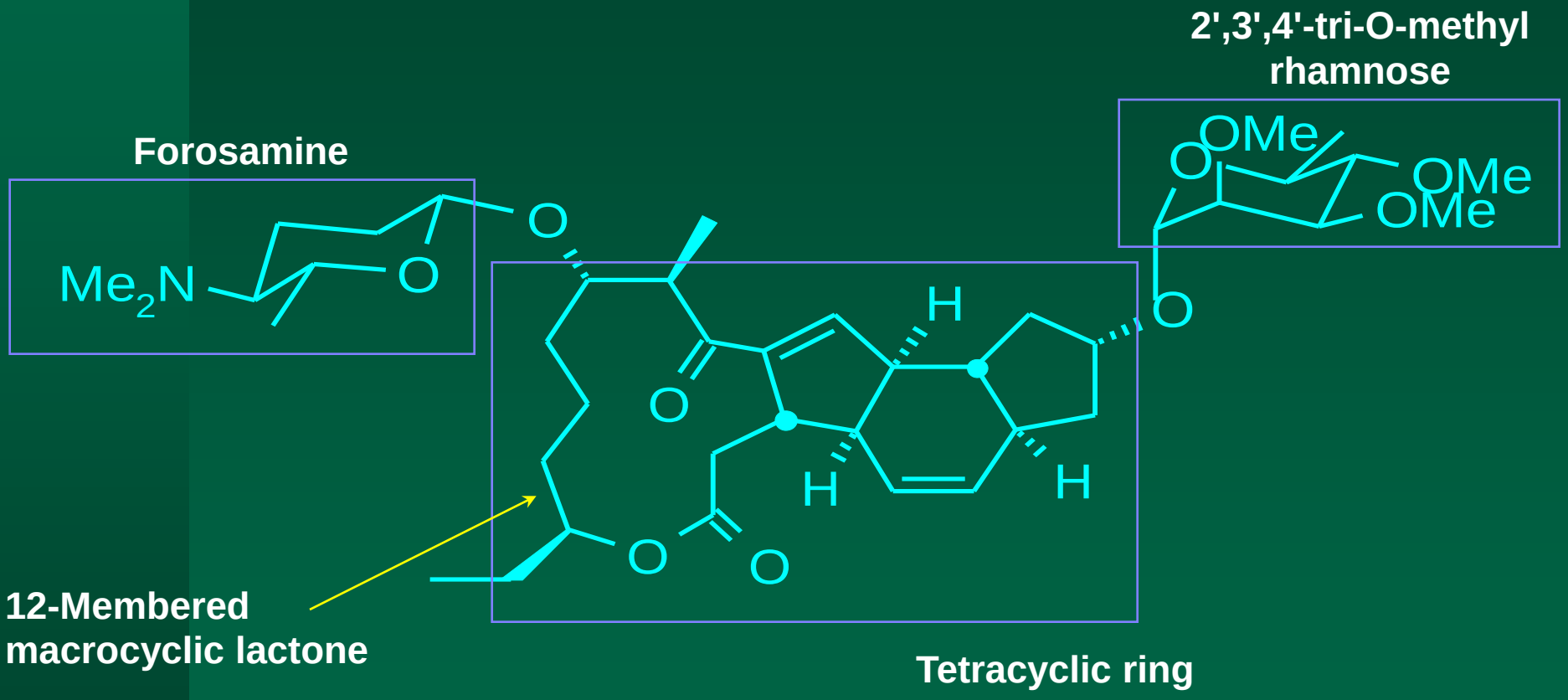
Kingdom: monera

Phylum: Firmicutes (thick walled, gram positive)

Class: Thallobacteria (branching bacteria - actinomycete)

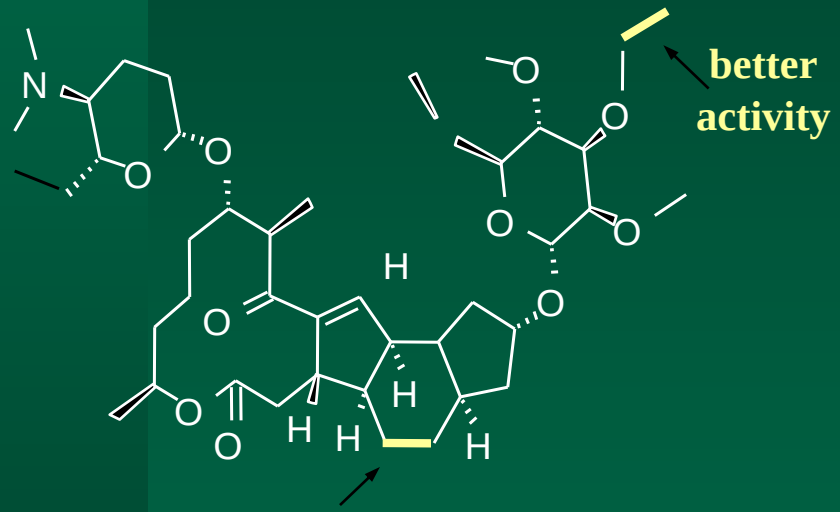
Characteristics: Aerobic, non-antibiotic, slow growing

Structure of spinosyn A

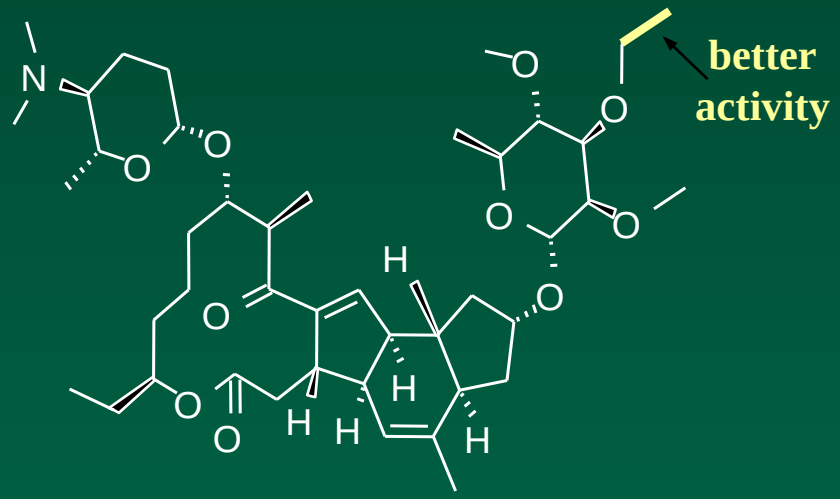


Spinetoram [Delegate 25WG]

Major component



Minor component



Chemical **modification of spinosyn** that resulted in increased photostablity and improved efficacy

SPINOSAD FORMULATIONS

Fruit Flies	%Active	Concentration
GF-120 Fruit Fly Bait	0.02%	200 ppm
Agricultural Crops		
Success	22.8%	2 lb/gal

Field Efficacy Trial of GF-120

Field Efficacy Trial - Methods

- Three treatments replicated 4 times
- GF-120 (1:4) at 20 oz/ac applied weekly and every other week from 26 June to 30 Oct.
- Treatments applied with hand sprayer

Field Efficacy Trial - Methods

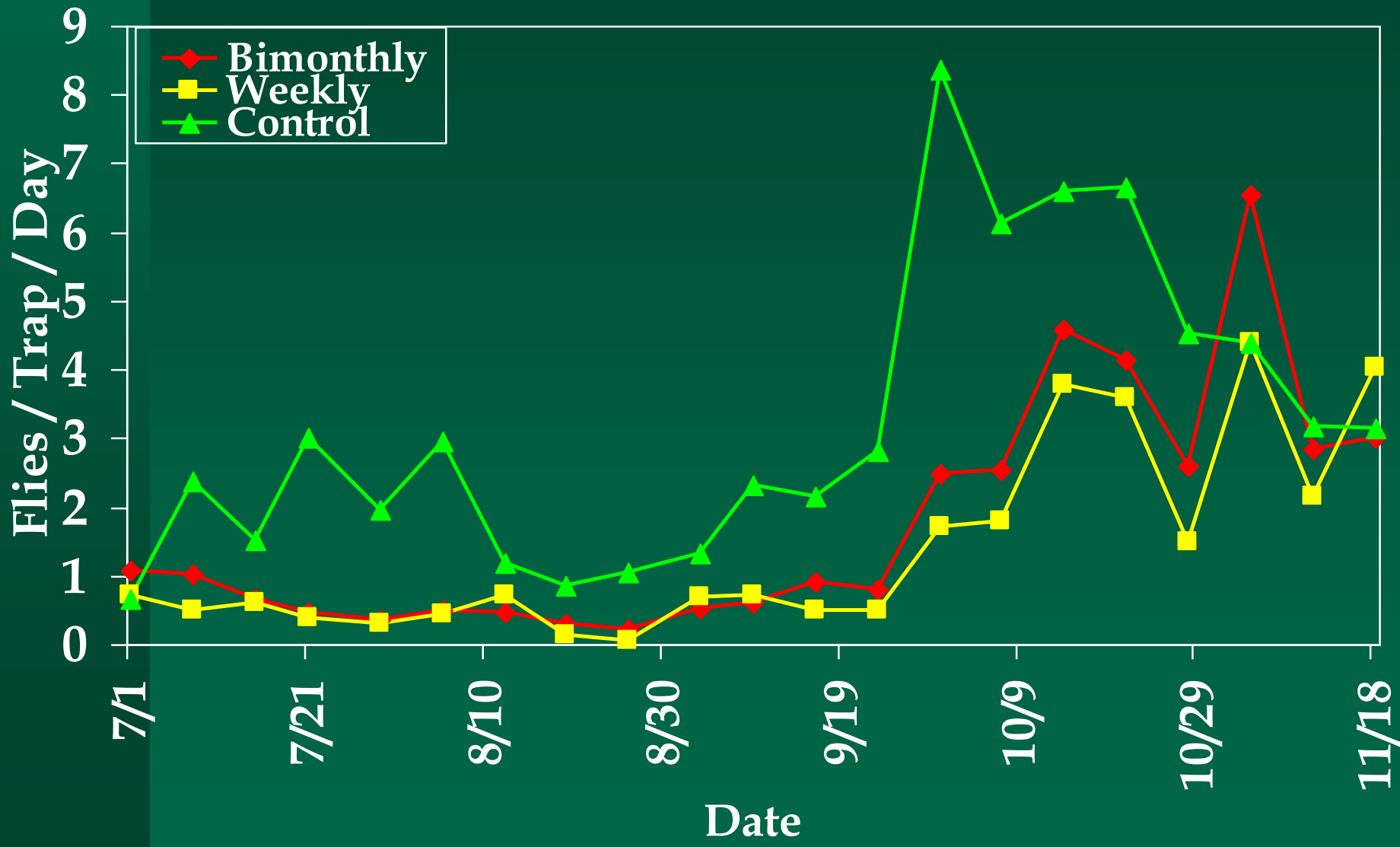
- Adults monitored weekly with ChamP+ Traps
- 50 Fruit/Rep monitored every other week and 250 Fruit/Rep at harvest for infestation

Field Efficacy Trial - Infested Fruit

	Mean Percent Infested Fruit		
Date	Weekly	Bimonthly	Control
12-Aug	0.0 a	0.4 a	2.0 b
26- Aug	0.4 a	3.6 a	2.5 a
9-Sept	0.4 a	1.2 a	4.0 b
23- Sept	0.8 a	2.8 a	9.5 b
7-Oct	2.8 a	4.8 a	28.0 b
21-Oct	7.2 a	12.4 a	42.5 b
4-Nov	6.8 a	8.0 a	30.5 b
18-Nov*	6.0 a	12.3 ab	24.3 b

*1000 fruit per treatment counted at harvest

Field Efficacy Trial - Seasonal Catch



IR-4 Insecticide Evaluation (Field)

IR-4 Field Efficacy Trial - Methods

- Six treatments replicated 4 times
- Treatments applied on 28 Oct.
- Danitol, Success and NuLure applied using hand-held orchard sprayer at 250 psi & 70 gal/ac

IR-4 Field Efficacy Trial 2004 - Methods

- GF-120 and blank bait applied on 10 leaves with 10uL droplets per replicate
- 25 OLFF per replicate exposed in cages for 24 hours at 0, 3, and 7 DAT

IR-4 Field Efficacy Trial 2004 - Results

Treatment	Rate/ 70 gal	Mean % Mortality 0 DAT	3 DAT	7 DAT
Success*	3.2 oz	25.2 bc	9.8 a	0.0 a
Danitol*	10.7 oz	38.6 cd	59.7 bc	19.0 b
Danitol*	21.3 oz	82.0 e	66.9 c	38.6 c
GF-120	1:4	45.1 d	44.2 b	4.1 a
NuLure	2.0 pt	7.1 ab	3.1 a	0.0 a
Blank Bait	1:4	1.8 a	1.0 a	0.0 a

*Treatments contained 2 pt NuLure/70 gal

IR-4 Field Efficacy Trial 2004 - Results

Treatment	Rate/ 70 gal	Mean % Corrected Mortality 0 DAT	3 DAT	7 DAT
Success*	3.2 oz	19.1 a	7.0 a	0.0 a
Danitol*	10.7 oz	34.5 a	58.2 b	19.0 b
Danitol*	21.3 oz	80.9 b	66.2 b	38.6 c
GF-120	1:4	43.9 a	43.7 b	4.1 ab

*Treatments contained 2 pt NuLure /70 gal

Danitol

- Apply from 10 2/3 to 16 oz/ac by ground
- Do not apply more than 42 2/3 oz for season
- 7 day PHI

Olive Fruit Fly - Spinosad resistance

Kakani, E.G. , N.E. Zygouridis, K.T. Tsoumani, N. Seraphides, F.G. Zalom and K.D. Mathiopoulos. 2010. Spinosad resistance development in wild olive fly populations in California. Pest Management Science. 66(4):447-453

- Topical Bioassay - 2007
- Ingestion bioassay - 2008
- Comparison of flies reared from field infested olives from sites in Greece, Cyprus and California to a susceptible control = Demokritos laboratory strain (has not been exposed to insecticides for 40 years)
- Probit analysis with 4 to 7 doses.

Olive Fruit Fly - Spinosad resistance

Correspondence between contact and ingestion bioassay protocols.

Population	LD_{50}-C (ng/fly)	LC_{50}-I (ng/µl)	LD_{50}-C / LC_{50}-I
Lab strain	4.98	0.32	15.56
Ohlone	51.93	3.66	14.19
Silverado	29.61	1.82	16.27
Tux	22.47	1.43	15.71
Solano	21.92	1.38	15.88
		Average	15.52

LD_{50}-C: Lethal dose by contact bioassay
LC_{50}-I : Lethal concentration by ingestion bioassay

Olive Fruit Fly - Spinosad resistance

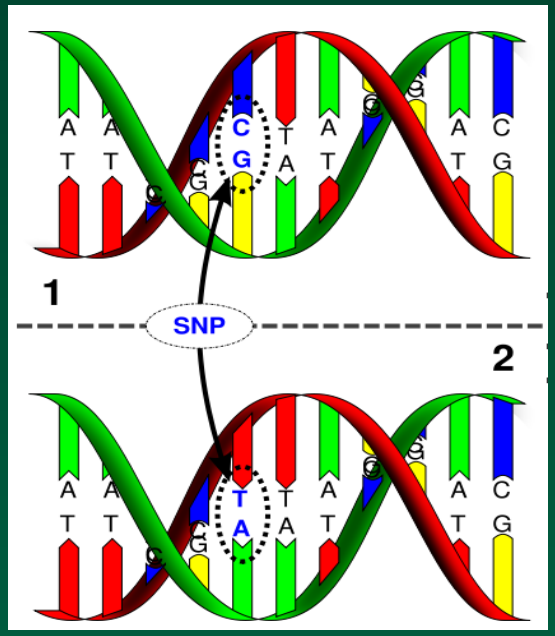
California Location	# of apps	RR
Sonoma 1-CA	69	13.28
Ohlone-CA	49	11.44
Sonoma 2-CA	60	10.69
Butte-CA	69	10.09
Stags Leap-CA	66	9.13
Silverado-CA	66	5.69
Ventura-CA*	43	5.50
Tux-CA	34	4.47
Chania-GR*	25	4.34
Solano-CA	16	4.31
Livermore-CA	0	4.03
Hudson-CA	0	3.78
Paso Robles-CA	13	3.69
San Luis Obispo-CA	17	3.16
San Jose-CA*	0	2.78
Davis-CA	0	2.47
UC Davis-CA	3	1.81
Oroville-CA	0	1.47

Greece Location	# of apps	RR
Aghios Nicolaos-GR*	8	3.09
Promiri-GR*	0	3.06
Livadia-GR	3	1.47
Drakia-GR	0	1.13
Argalasti-GR	0	0.94
Mytilini-GR	2	0.38

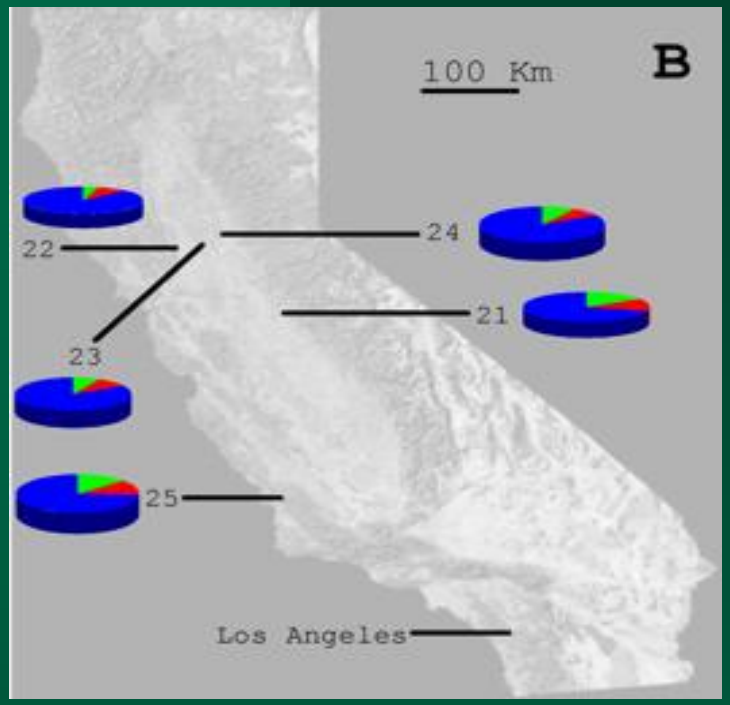
Cyprus Location	# of apps	RR
Nicosia-CY*	0	1.31
Pafos-CY*	3	1.28
Limassol-CY*	0	1.19
Katokopia-CY*	0	1.16
Mazotos-CY*	0	1.00
Dromolaxia-CY*	0	0.69
Evrychou-CY	0	0.19
Zygi-CY	0	0.16
LAB STRAIN	0	1.00

Olive Fruit Fly - Origin based on microsatellite markers

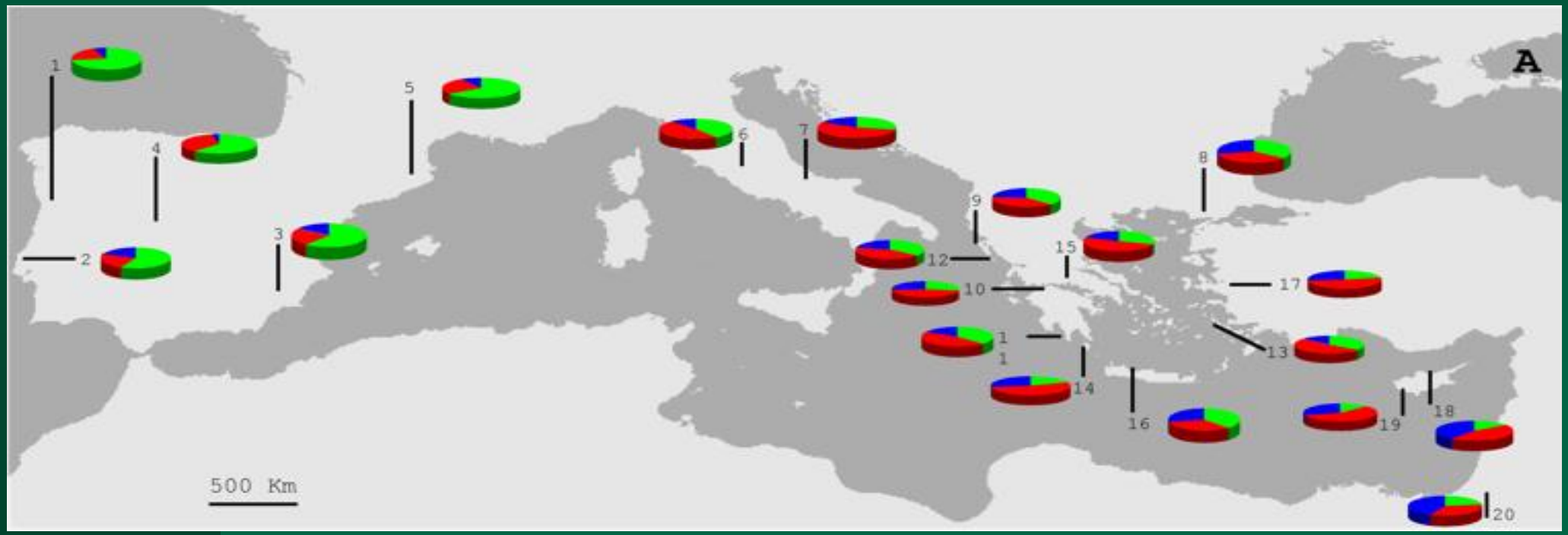
Markers included genes for organophosphate resistance.



Zygouridis, N.E., A.A. Augustinos, F.G. Zalom, and K.D. Matiopoulos. 2009. Analysis of olive fly invasion in California based on microsatellite markers. Heredity 102(4): 402-12.

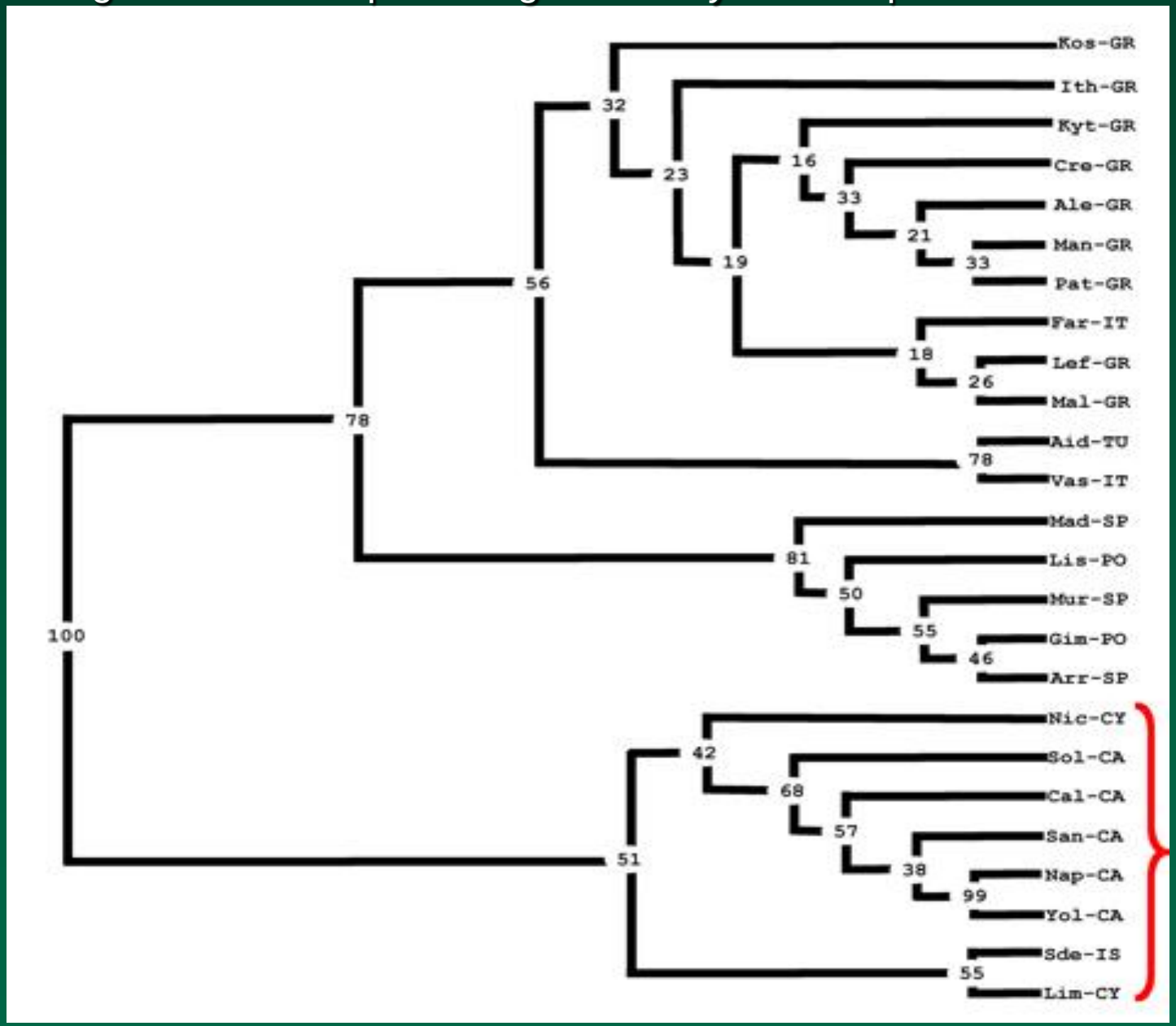


Collection sites and geographical representation of the clustering outcome, assuming three hypothetical clusters



UPGMA dendrogram constructed after 100 bootstrap resamples, based on Nei's (1972) genetic distances, showing the relationships among the twenty-five samples studied.

TU=Turkey,
IS=Israel,
CY=Cyprus,
GR=Greece,
IT=Italy,
SP=Spain,
PO=Portugal,
CA=California



Assignment of groups of individuals of California samples to the three described genetic groups plus Israel, according to GeneClass 2.0 software

Samples to be assigned	Reference groups							
	1	%	2	%	3	%	4	%
Cal-CA	Cypriot	99.828	Israeli	0.165	Central Med	0.007	Iberian	0.000
Nap-CA	Cypriot	77.477	Israeli	22.523	Central Med	0.000	Iberian	0.000
Sol-CA	Israeli	100.000	Cypriot	0.000	Central Med	0.000	Iberian	0.000
Yol-CA	Israeli	99.993	Cypriot	0.007	Central Med	0.000	Iberian	0.000
San-CA	Israeli	100.000	Cypriot	0.000	Central Med	0.000	Iberian	0.000