Santa Clara County Vector Control District, Disease Surveillance Section

Annual Report 2011

- About the Disease Surveillance Section
- Public Service Requests
- Lyme Disease Surveillance
- West Nile Virus Surveillance
- Hantavirus in Rodents Surveys
- Rickettsia 364D
- Honey bees in Historic House
- Laboratory Developments

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About the Disease Surveillance Section

The Disease Surveillance Section (Section) is a division of the Santa Clara County Vector Control District that provides field detection and monitoring for vector-borne diseases. Currently, Lyme disease and West Nile virus are the two main vector-borne diseases in humans in Santa Clara County, while Sin Nobre Virus (hantavirus) and plague are endemic but rarer. The Section also functions to provide the public with information on medical and urban entomology including issues resulting from a variety of biting and stinging arthropods, cockroaches and flies. This report summarizes the Section's activities during the 2011 calendar year.

The Section is currently composed of 7 staff members; Vector Control Scientific-Technical Services Manager (Noor Tietze, Ph.D.), the Vector Ecologist (Nayer Zahiri, Ph..D.) and five Vector Control Technician III's (Bill Shipway, Caroline Dunkelberger, Mark Marden, Menou Thaopraseuth and Mike Stephenson). Each Technician has been assigned a geographic zone to facilitate designation of public service requests, while project-oriented surveillance efforts were largely independent of designated zones. Starting July 1, 2012 we hope to be adding a coded Laboratory Assistant position to the group, who will be assisting in colony maintenance and other routine lab duties.

Besides having operated from the newly remodeled district headquarters and laboratory for a full year, there were some notable developments: the Section implemented a new in-house diagnostic tool, polymerase chain reaction (PCR) for lyme disease and West Nile virus detection. New protocols were adopted for sample preparation and PCR analysis. A new sentinel chicken flock was established behind the laboratory at District headquarters. New Jersey light traps were redeployed at sites across the county to weekly monitor mosquito counts from stationary sampling sites.

Public Service Requests

During 2011, the Disease Surveillance Section responded to 1,281 requests for service regarding a broad range of vector and vector-borne disease organisms (Table 1). The greatest number of requests was for West Nile Virus surveillance detection in dead birds and squirrels (324) that included calls referred to us via the State's Dead Bird Hotline. In 2011 there was a continued increase in bedbug requests (Figure 1) that required educating tenants and property managers as well as collaboration with municipal code enforcement. Yellowjackets calls were significantly higher than historic averages during September through November and nest treatments were justified in a number of cases. Headlice calls were also above average during November, 2011.

Row Labels	Count of Service Requests
Bed Bugs	222
Bee Swarm	81
Bees Info	52
Cockroach	117
DeadBirds	324
Fleas	27
Flies	30
Lice	21
Lyme	1
Mites	42
Other Ins	105
Other VBD	4
Spiders	35
Ticks	55
Wasps/Yllw	165
Grand Total	1281

Table 1. Count of public requests for service that were responded to by the Disease Surveillance Section during 2011 (1/1/2011-12/27/2011).

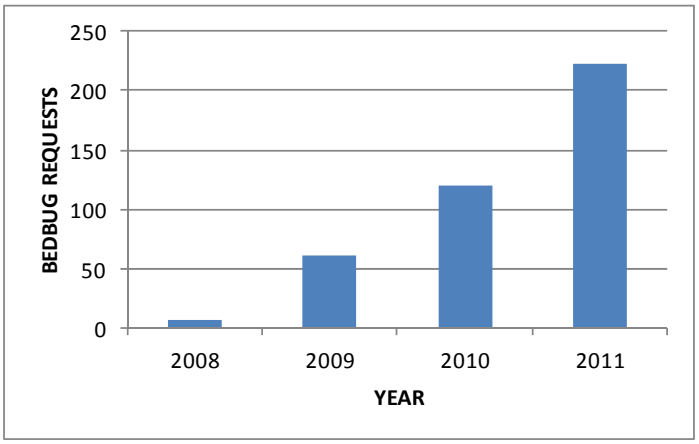

Figure 1. Rise of bedbug requests to the Disease Surveillance Section during 2008-2011

There has been a steady rise in bedbug calls to the Section during the last four years. When compared to cockroach calls, bedbug requests were more clustered in geographic distribution and occurred in areas of significantly higher human population density and housing unit density. Census data indicate this trend to be driven by infestations in rental units of "low rent districts", where property managers must contend with expensive pest control services and unhappy tenants. Certain cases resulted in the unfortunate eviction of tenant. The need for good lease and rental agreement policies pertaining to bedbugs was apparent during discussions with both parties, especially since bedbug "eradication" is more involved and complicated than other pest control issues. Tenants are typically expected to comply with special laundering and cleanup instructions to allow pest control to effectively do their job that often requires temporary evacuation of the premises.

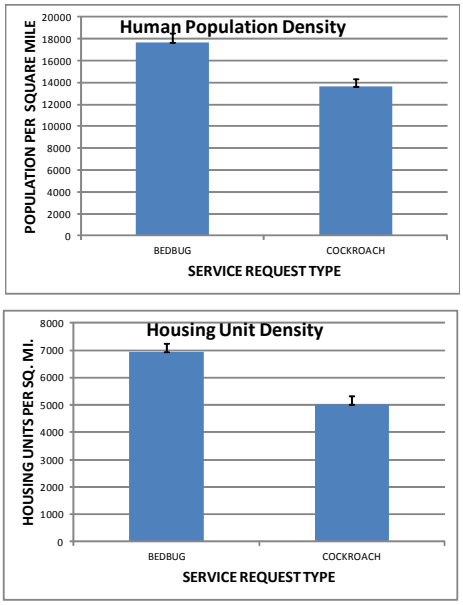

Figure 2. Population and housing unit density in census blocks underlying bedbug and cockroach public service requests based on 2010 U.S. Census data (bars indicate standard error)

Lyme Disease in Deer Tick Surveillance

The Section routinely samples ticks for Lyme disease during the winter season focusing on adult deer ticks found on trails in parks and other recreational areas. Between November and March, 174 tick drag samples recovered 2,154 female and 1,360 male ticks and resulted in positive Lyme disease detections in 21 females and 23 males (see Table 2 below). The infection rate in adult female ticks was 0.97%, while that of male ticks was 1.69%. Tick sampling was standardized by using a "tick flag" (Figure 4), a one meter square piece of canvas-like material that is dragged along trail edges to collect questing or host-seeking ticks (Figures 3 and 4). Based on calculations, a sampling size of about 150 ticks is needed to accurately estimate a local infection rate.

Table 2. Lyme disease surveillance results in Santa Clara County from November 2010 to March 2011 per park and trail sampled.

PARK NAME	TOTAL MALES	TOTAL FEMALES	MALES POS	FE-MALES POS	TOTAL POS	TOTAL SAM-PLED	TOTAL % POS
ALUM ROCK PARK	100	132	0	2	2	232	0.86
ARASTRADERO PRESERVE P.A.	12	32	1	1	2	44	4.55
BEAR CREEK OSD	69	110	6	2	8	179	4.47
BEL GATOS PARK	29	72	0	0	0	101	0.00
CALEO CO PK	41	55	1	0	1	96	1.04
CALERO CO PK, FIG. TRAIL	4	1	0	0	0	5	0.00
CALERO CO PK, FIGUEROA TR		10		0	0	10	0.00
CAN D' ORO OSA, MAYFAIR RNCH T	10	43	0	0	0	53	0.00
CANADA DE ORO OSA	4	11	0	0	0	15	0.00
CHESBRO DAM	87	62	1	0	1	149	0.67
COYOTE LAKE CO PK	7	20	0	0	0	27	0.00
COYOTE PARK	5	18	0	0	0	23	0.00
E. LEVIN CO PK-LOS COCHES RDGE	18	19	0	0	0	37	0.00
ED LEVIN COUNTY PARK	60	66	0	0	0	126	0.00
ED LEVIN-SPRING VALLEY TRAIL	32	38	0	0	0	70	0.00
FOOTHILLS OSP - TOYON TRAIL	27	41	1	2	3	68	4.41
FOOTHILLS OSP - VISTA HILL	8	11	0	0	0	19	0.00
FOOTHILLS PARK - STEEP HOLLOW TRAIL	10	14	1	0	1	24	4.17
FOOTHILLS PARK - SUNRISE TRAIL	22	43	0	0	0	65	0.00
FREMONT OLDER OSP	51	101	1	2	3	152	1.97
H. COE STP	25	18	0	0	0	43	0.00
HENRY COE SP CORRAL TR.	4	20	0	0	0	24	0.00
HENRY COE SP FOREST TR	15	30	0	0	0	45	0.00
HENRY COE SP MANZANITA TRAIL	32	74	0	1	1	106	0.94
HENRY COE SP, COIT RD	9	24	0	0	0	33	0.00
HENRY COE SP, KAISER-ETNA RD	9	8	0	0	0	17	0.00
HENRY COE STATE PARK	15	33	1	0	1	48	2.08
HENRY COE-COYOTE CREEK RD	16	27	0	0	0	43	0.00
LEXINGTON DAM	77	80	0	2	2	157	1.27
MT MADONNA, BLUE SPRING TR	19	48	0	1	1	67	1.49
MT MADONNA, MERRY-GO-ROUND TR	18	18	0	0	0	36	0.00
MT MADONNA, RIDGE TRAIL	2	7	0	0	0	9	0.00
MT. MADONNA - RIDGE TRAIL	6	19	1	0	1	25	4.00
MT. MADONNA - SPRIG LAKE	4	9	0	0	0	13	0.00
PICCHETTI RANCH/ZINFANDEL TR	50	64	0	0	0	114	0.00
PICCHETTI WINERY OSP	9	19	0	0	0	28	0.00
PICHETTI RANCH OSP ORCHARD LOOP TR.	4	15	0	0	0	19	0.00
QUICKSILVER COUNTY PARK	17	16	1	2	3	33	9.09
QUICKSILVER PK. WEB CYN	23	71	0	0	0	94	0.00
RANCHO CANADA DEL ORO-MAYFAIR	11	20	0	0	0	31	0.00
RANCHO SAN ANTONIO	80	126	1	2	3	206	1.46
SANBORN CO PK, SANBORN TR	16	26	0	0	0	42	0.00
SANBORN COUNTY PARK	9	29	2	1	3	38	7.89
SANTA TERESA PARK	54	91	0	0	0	145	0.00
SANTA TERESA PK	8	45	0	0	0	53	0.00
SIERRA AZUL - WOODS TR.	21	55	2	0	2	76	2.63
SIERRA AZUL OSP - BARLOW RD.	22	18	0	0	0	40	0.00
SIERRA AZUL OSP, WOODS RD	26	39	1	3	4	65	6.15
STEVENS CREEK PARK	97	75	1	0	1	172	0.58
UVAS CANNYON	12	35	1	0	1	47	2.13
UVAS CANYON	8	29	0	0	0	37	0.00
UVAS CANYON CO PK, KNIBBS NOB	4	12	0	0	0	16	0.00
UVAS CANYON-ALEC CANYON TR	17	30	0	0	0	47	0.00
UVAS CANYON-WATERFALL LOOP TR	25	25	0	0	0	50	0.00
GRAND TOTAL	1360	2154	23	21	44	3514	

Figure 3-4. Technician III, Michael Stephenson dragging for ticks (top photo) and checking tick flag (bottom photo).

Figure 5. Adult *Ixodes pacificus;* male (on left) and female (on right)

West Nile Virus Surveillance

Sentinel Chickens

Forty nine sentinel chickens were maintained in seven flock sites distributed across the county from Gilroy to Palo Alto and Milpitas. The red leghorn chickens (Figure 6) were bled twice monthly from April to November to sample for arboviruses. The chickens are of great value for localized detection of West Nile virus due to their continuous and stationary presence throughout the season. In addition to West Nile Virus, the sentinels are tested for Saint Louis Encephalitis virus and Western Equine Encephalomyelitis. No positive chicken results were found in 2011.

Figure 6. Sentinel chicken coop and red leghorn chickens.

Figure 7. Dead crow tested for West nile virus.

Field Detection in Dead Birds and Squirrels

In 2011 there were 37 positive birds (all American crows) and one positive eastern gray squirrel. The state Dead Bird Hotline received 675 public reports of dead birds and squirrels of which about 332 were entered as service requests in the District's Vector Control Management System (VCMS). The majority of the birds processed were crows and were tested in-house using the VecTest Antigen Panel Assay System.

West Nile Virus Detection in Adult Mosquitoes

Based on in-house protocol, WNV-positive dead animal detections, primarily American crows, triggered mosquito trapping efforts within a one-mile radius using 40 EVS traps. A total of 1,376 traps were set during the course of the year including traps set as a response to 37 positive dead animals and routine trapping at the San Jose Pollution Control Plant and Llagas Creek. The trapping resulted in 387 mosquito samples tested totaling 3275 *Culex pipiens* and 1430 *Culex tarsalis* captured and 10 positive samples (5 positive *Culex pipiens* and 11 positive *Culex tarsalis*) using the in-house PCR system.

Figures 8-9. New in-house PCR techniques were utilized in 2011 for WNV detection in adult mosquitoes using Applied Biosystems Magmax and RT7500 thermocycler (left image) and expertise and pipetting skills of Dr. Zahiri (right).

Hantavirus Surveillance

In 2011, the Disease Surveillance Section completed a single hantavirus survey at Mount Umunhum, on Midpeninsula Open Space District property. Mt Umunhum is the third highest peak in the Santa Cruz Mountain range with an elevation of 3486 feet above sea level.

On August 11, 2011, Dan Salkeld and his intern collaborated with the Section in sampling rodents at Mt. Umunhum. About 60 Sherman traps were set in the defunct military base capturing the following cricetid rodents: 15 brush mice (*Peromyscus boylii*), 10 wood rats (*Neotoma fuscipes*) and 1 deer mouse. (*P. maniculatus*). All negative for Sin Nobre Virus and plague. All rodents were set free following blood sampling using anesthetic isoflurane and retro-orbital capillary tube sampling technique.

Figure 10. Rodent sampling site clean up following bleeding of deer and brush mice and wood rats.

Figure 11 . Denise Bonilla and Dan Salkeld photographing larval ticks on "tick flag" in Saratoga, Ca.

Rickettsia 364D

A resident of Saratoga was diagnosed with a rare infection on her arm that resembled an anthrax eschar. During a site inspection of her property, on October 18, 2011, state health officials Denise Bonilla and Dan Salkeld (Figure 11) were able to recover hundreds of "seed ticks" or larval stage *Haemaphysalis leporispalustra* that parasitize rabbits. Short drags under a small walnut tree caused the white flag material to become peppered with the tiny ticks. Larval stage *Dermacentor albipictus, Dermacentor occidentalis* and *Ixodes pacificus* were also identified. from samples taken on the property The vector species to implicate in this case remains unknown..

Honey Bees in Historic House

Feral honey bees had infested this house once occupied by the Countess Remillard Dandini (circa 1870-1918), now it is a recognized historic house in San Jose. The trustee managing the property was contending with the aging wood structure and one or more massive honey bee colonies in the ceiling of the Sunroom. Abating the bees became a long-term project due to specialized repair work to the historic house and required collaboration by local beekeepers.

Figure 12. Historic House once occupied by Countess,

Laboratory Developments

During 2011, the colony of *Culex pipiens* complex mosquitoes (Figure 13) thrived through 23 generations in the "Insectary" maintained at a balmy 78F and 75% humidity. Chicken blood meals were provided using the Hemotek System to heat blood feeders to simulate host body temperature (Figure 14). The adult mosquitoes were also offered sugar meals using either 10% sucrose solution or raisins. Larval mosquitoes were fed pellets of rabbit chow.

Figure 13. Mosquito "Insectary" showing antique enamel metal pans kindly donated by UCR professor, Mir Mulla.

Figure 14. Adult mosquito cages in getting fed blood meal by Dr. Zahiri using the Hemotek apparatus.

A series of bioassays were initiated to create a baseline of susceptibility for the *Culex pipiens* colony to District larvicides. Using 20 early 4th instar larvae per disposable cup, replicated mosquito arenas were exposed to serial dilutions of bacterial control agents, *Bacillus thuringiensis* var. *israelensis and Bacillus sphaericus.* Resulting mortalities were analyzed using Probit Analysis as shown below.

List of bioassay results completed for SCCVCD larvicides against *Culex pipiens* hybrid (colony) for 50 and 95% lethal concentrations (ppm) and 95% confidence intervals.

Material	Date	Duration (hrs)	LC95	95% Confidence Limits Lower	Upper
Vectobac G[1]	4/5/11	24	4.072	3.483	5.083
Vectobac G[2]	4/6/11	24	7.156	5.506	10.930
Vectobac 12AS	4/6/11	24	0.554	0.447	0.754
Vectolex CG[1]	4/14/11	48	3.202	2.094	6.197
Vectomax CG[3]	5/19/11	48	0.431	0.361	0.556

[1]Stock solution was prepared within 1 hour of treatment [2]Stock solution was prepared about 24 hours previous to treatment

The colony was also used to produce adult mosquitoes for field exposure tests during fogging operations to validate product efficacy. Colony specimens were also used for in-house training and outreach events.