



Summary of Studies Supporting USDA Product Licensure

Establishment Name	Elanco US Inc.
USDA Vet Biologics Establishment Number	196
Product Code	2126.01
True Name	Borrelia Burgdorferi Bacterin
Tradename(s) / Distributor or Subsidiary (if different from manufacturer)	Ultra Duramune Lyme - Elanco US Inc.
Date of Compilation Summary	November 29, 2017

Disclaimer: Do not use the following studies to compare one product to another. Slight differences in study design and execution can render the comparisons meaningless.

Study Type	Efficacy
Pertaining to	<i>Borrelia burgdorferi</i>
Study Purpose	To demonstrate effectiveness against <i>Borrelia burgdorferi</i> in dogs.
Product Administration	Two doses were administered subcutaneously (SC) or intramuscular (IM) 3 weeks apart.
Study Animals	<p>Study I: Thirty-three (33) 8-14 week old puppies serologically negative for <i>B. burgdorferi</i> were used in the final study analysis. Animals were randomized into one group 15 IM vaccinates, one group of 8 SC vaccinates, and one group of 10 controls.</p> <p>Study II: Thirty (30) 8 week old puppies serologically negative for <i>B. burgdorferi</i> were used in the final study analysis. Animals were randomized into one group of 20 SC vaccinates and one group of 10 controls.</p>
Challenge Description	<p>Study I: Four weeks after second vaccination all animals were challenged with <i>Borrelia burgdorferi</i>.</p> <p>Study II: Three weeks after second vaccination all animals were challenged with <i>Borrelia burgdorferi</i>.</p>
Interval observed after challenge	<p>Study I: Dogs were observed daily for 90 days after challenge for clinical signs associated with <i>B. burgdorferi</i>.</p> <p>Study II: Dogs were observed daily for 126 days after challenge for clinical signs associated with <i>B. burgdorferi</i>.</p>
Results	<p>Dogs were evaluated for clinical arthritis, and the detection of <i>B. burgdorferi</i> in blood, fluids, and tissues. Clinical arthritis was defined as the number of discontinuous occurrence of limp and/or lameness for a specific limb. Blood, synovial fluid, lymph nodes, skin and urine samples were collected for <i>B. burgdorferi</i> isolation and/or detection.</p> <p>Data tables are appended to the end of this summary.</p>
USDA Approval Date	December 6, 1995

Study I: Arthritic Signs Observed

Dog	Treatment	Stiff	Lame	Limping
1	IM Vaccinate			
2	IM Vaccinate			
3	IM Vaccinate			
4	IM Vaccinate			
5	IM Vaccinate			
6	IM Vaccinate			
7	IM Vaccinate	87		
8	IM Vaccinate			
9	IM Vaccinate			
10	IM Vaccinate			
11	IM Vaccinate			
12	IM Vaccinate			
13	IM Vaccinate			
14	IM Vaccinate			
15	IM Vaccinate		85	

Dog	Treatment	Stiff	Lame	Limping
16	SC Vaccinate		87	
17	SC Vaccinate			
18	SC Vaccinate			
19	SC Vaccinate			
20	SC Vaccinate	78		
21	SC Vaccinate			
22	SC Vaccinate			
23	SC Vaccinate			

Dog	Treatment	Stiff	Lame	Limping
24	Control	59, 61, 87		86
25	Control	52, 62, 64, 65, 70, 71, 72, 73, 74, 75, 87	61, 77, 78	79, 80, 85
26	Control	74, 75	78, 79	80
27	Control	63, 64, 87		
28	Control	49		
29	Control	54, 58, 64, 76		
30	Control	59,78, 80		65, 69, 70, 71, 72, 73, 75, 76, 77, 79, 87
31	Control	41, 52, 57, 59, 60, 61		58, 75, 90
32	Control	50 , 55, 56, 58, 62, 70, 76	58, 59, 60, 61, 69, 73, 75, 77, 78, 85	52, 54, 56, 57, 58, 59, 60, 62, 65, 66, 68, 70, 71, 72, 74, 79, 80, 84, 86, 87, 90
33	Control	38, 41, 42,43, 45, 50, 63, 65, 66, 69, 71, 84	54, 58, 59, 60, 61, 62, 72, 73, 76, 77, 79	38,41,49,52,53, 55, 56, 57, 65, 66, 68, 69, 70, 74, 75, 78, 80, 86, 87, 90

Number - represents the day post challenge the clinical sign was observed

Blank - No signs observed

Clinical arthritis was defined as the number of discontinuous occurrence of limp and/or lameness for a specific limb

Study I: Detection of B Burgdorferi (Blood)

Dog	Treatment	9DPC	13DPC	20DPC	24DPC	31DPC	34DPC	35DPC	38DPC
1	IM Vaccinate								
2	IM Vaccinate								
3	IM Vaccinate								
4	IM Vaccinate								
5	IM Vaccinate								
6	IM Vaccinate								
7	IM Vaccinate								
8	IM Vaccinate								
9	IM Vaccinate								
10	IM Vaccinate								
11	IM Vaccinate								
12	IM Vaccinate								
13	IM Vaccinate								
14	IM Vaccinate								
15	IM Vaccinate								

Dog	Treatment	9DPC	13DPC	20DPC	24DPC	31DPC	34DPC	35DPC	38DPC
16	SC Vaccinate								
17	SC Vaccinate								
18	SC Vaccinate								
19	SC Vaccinate								
20	SC Vaccinate								
21	SC Vaccinate								
22	SC Vaccinate								
23	SC Vaccinate								

Dog	Treatment	9DPC	13DPC	20DPC	24DPC	31DPC	34DPC	35DPC	38DPC
24	Control							+	
25	Control								
26	Control								
27	Control								
28	Control	+		+		+			+
29	Control					+			
30	Control								
31	Control				+		+		
32	Control		+						
33	Control						+		

*Samples were collected periodically from -1DPC through 90DPC, only dates with positive detection are listed. DPC is day post challenge.

"+" - Positive for Borrelia Detection

Blank - Negative for Borrelia Detection

Study I: Detection of B Burgdorferi (Tissues and Fluid) at 90DPC

Dog	Treatment	Lymph Nodes	Synovial Fluid	Skin	Urine
1	IM Vaccinate				
2	IM Vaccinate				
3	IM Vaccinate			no sample	
4	IM Vaccinate				
5	IM Vaccinate				
6	IM Vaccinate				
7	IM Vaccinate				
8	IM Vaccinate				
9	IM Vaccinate				
10	IM Vaccinate				
11	IM Vaccinate		+		
12	IM Vaccinate				
13	IM Vaccinate		+		
14	IM Vaccinate				
15	IM Vaccinate		+		

Dog	Treatment	Lymph Nodes	Synovial Fluid	Skin	Urine
16	SC Vaccinate				
17	SC Vaccinate		+		
18	SC Vaccinate				
19	SC Vaccinate		+		
20	SC Vaccinate	+			
21	SC Vaccinate	+			
22	SC Vaccinate				
23	SC Vaccinate				

Dog	Treatment	Lymph Nodes	Synovial Fluid	Skin	Urine
24	Control			+	
25	Control		+	+	
26	Control	+		+	no sample
27	Control		+		
28	Control		+		+
29	Control		+	+	
30	Control	+			+
31	Control		+	+	+
32	Control		+		
33	Control			+	

DPC is day post challenge

"+" - Positive for Borrelia Detection

Blank - Negative for Borrelia Detection

Study II: Arthritic Signs Observed

Dog	Treatment	Stiff	Lame	Limping
1	SC Vaccinate			
2	SC Vaccinate			
3	SC Vaccinate	54, 77, 95		
4	SC Vaccinate			
5	SC Vaccinate	41, 55, 56, 58, 112		
6	SC Vaccinate			
7	SC Vaccinate	104		
8	SC Vaccinate			
9	SC Vaccinate			
10	SC Vaccinate			
11	SC Vaccinate	95, 100		28, 98, 99
12	SC Vaccinate		41	
13	SC Vaccinate	98		
14	SC Vaccinate	90		
15	SC Vaccinate	80		84
16	SC Vaccinate	42		76
17	SC Vaccinate			
18	SC Vaccinate			
19	SC Vaccinate	120		
20	SC Vaccinate	44, 45, 57	41, 52, 54	77, 79, 91, 95, 104

Dog	Treatment	Stiff	Lame	Limping
21	Control	30, 50, 53, 56, 58, 63, 95		78
22	Control			
23	Control	63, 65, 93, 94, 106		43, 55, 100
24	Control	65, 82		
25	Control	38, 62, 63, 75, 98, 99, 100, 103, 106		104
26	Control	56, 71, 78, 93, 99,	59, 60, 61, 72, 73, 74, 75, 80, 81, 82, 83, 89, 90, 103, 104, 105, 106, 107, 108, 120, 121, 122, 125, 126	76, 77, 84, 85, 98, 109, 110, 115
27	Control	51, 79, 103		
28	Control	57, 105	105, 125	124
29	Control			
30	Control	104	76, 77, 126	75, 78, 82, 90, 101

Number - represents the day post challenge the clinical sign was observed

Blank - No signs observed

Clinical arthritis was defined as the number of discontinuous occurrence of limp and/or lameness for a specific limb

Study II: Detection of B Burgdorferi (Blood)

Dog	Treatment	30DPC	34DPC	35DPC	36DPC	37DPC	41DPC	43DPC	44DPC	76DPC	103DPC
1	SC Vaccinate										
2	SC Vaccinate										
3	SC Vaccinate										
4	SC Vaccinate										
5	SC Vaccinate										
6	SC Vaccinate										
7	SC Vaccinate										
8	SC Vaccinate					+					
9	SC Vaccinate										
10	SC Vaccinate										
11	SC Vaccinate										
12	SC Vaccinate										
13	SC Vaccinate										
14	SC Vaccinate										
15	SC Vaccinate										
16	SC Vaccinate										
17	SC Vaccinate										
18	SC Vaccinate										
19	SC Vaccinate										
20	SC Vaccinate										

Dog	Treatment	30DPC	34DPC	35DPC	36DPC	37DPC	41DPC	43DPC	44DPC	76DPC	103DPC
21	Control									+	
22	Control										
23	Control										
24	Control		+	+	+	+	+		+		
25	Control	+	+								
26	Control					+	+	+			+
27	Control										
28	Control										
29	Control										
30	Control										

*Samples were collected periodically from -1DPC through 126DPC, only dates with positive detection are listed. DPC is day post challenge.

"+" - Positive for Borrelia Detection

Blank - Negative for Borrelia Detection

Study II: Detection of B Burgdorferi (Tissues and Fluid) at 126DPC

Dog	Treatment	Lymph Nodes	Synovial Fluid	Skin	Urine
1	SC Vaccinate	+			
2	SC Vaccinate	+			
3	SC Vaccinate		+		+
4	SC Vaccinate	+			
5	SC Vaccinate	+			+
6	SC Vaccinate				
7	SC Vaccinate	+			
8	SC Vaccinate	+		+	
9	SC Vaccinate				
10	SC Vaccinate				
11	SC Vaccinate				+
12	SC Vaccinate		+		+
13	SC Vaccinate	+			
14	SC Vaccinate	+	+	+	
15	SC Vaccinate	+			+
16	SC Vaccinate		+		+
17	SC Vaccinate	+	+	+	
18	SC Vaccinate		+		
19	SC Vaccinate				
20	SC Vaccinate	+		+	

Dog	Treatment	Lymph Nodes	Synovial Fluid	Skin	Urine
21	Control	+	+		
22	Control	+	+	+	
23	Control		+		
24	Control		+	+	+
25	Control	+	+	+	+
26	Control	+	+	+	+
27	Control	+	+		
28	Control	+	+	+	+
29	Control	+	+	+	
30	Control	+			

DPC is day post challenge

"+" - Positive for Borrelia Detection

Blank - Negative for Borrelia Detection

Study Type	Efficacy
Pertaining to	<i>Borrelia burgdorferi</i>
Study Purpose	To demonstrate effectiveness against <i>Borrelia burgdorferi</i> for one year duration of immunity.
Product Administration	Two doses were administered subcutaneously (SC) 3 to 4 weeks apart.
Study Animals	Study I: Twenty-four (24) dogs serologically negative for <i>B. burgdorferi</i> were used in the final study analysis. Animals were randomized into one group of 12 SC vaccinates and one group of 12 controls. Study II: Sixteen (16) dogs serologically negative for <i>B. burgdorferi</i> were used in the study. Animals were randomized into one group of 5 SC vaccinates, and one group of 11 controls.
Challenge Description	One year after second vaccination all animals were challenged with <i>Borrelia burgdorferi</i> .
Interval observed after challenge	Dogs were observed for 5 months after challenge.
Results	Dogs were evaluated for <i>B. burgdorferi</i> disease. Clinical disease was evaluated by clinical arthritis, the isolation of <i>B. burgdorferi</i> in skin, and detection of <i>Borrelia</i> infection by antibody profile. Clinical arthritis was defined as the number of discontinuous occurrence of limp and/or lameness for a specific limb. Results: Study I 10/12 (83%) - Controls positive for <i>B. burgdorferi</i> disease 2/12 (17%) - SC Vaccinates positive for <i>B. burgdorferi</i> disease Data tables are appended to the end of this summary. No animals (vaccinates or controls) were observed with clinical arthritis in this study. Study II 10/11 (91%) - Controls positive for <i>B. burgdorferi</i> disease 1/5 (20%) - SC Vaccinates positive for <i>B. burgdorferi</i> disease Data tables are appended to the end of this summary. Only one control animal was observed with clinical arthritis in this study. Dog #13 (control) was observed to be lame on 134DPC. All other animals were negative for clinical arthritis.
USDA Approval Date	January 2, 1997

Study I Isolation of *B. Burgdorferi* in Skin Samples

Animal	Treatment Group	28DPC*	63DPC	91DPC	118DPC
1	SC Vaccinate	-	+	-	+
2	SC Vaccinate	-	-	-	+
3	SC Vaccinate	-	-	-	-
4	SC Vaccinate	-	-	-	-
5	SC Vaccinate	-	-	-	-
6	SC Vaccinate	-	-	-	-
7	SC Vaccinate	-	-	-	-
8	SC Vaccinate	-	-	-	-
9	SC Vaccinate	-	-	-	-
10	SC Vaccinate	-	-	-	-
11	SC Vaccinate	-	-	-	-
12	SC Vaccinate	-	-	-	-
13	Control	-	-	-	-
14	Control	-	-	+	+
15	Control	-	+	-	+
16	Control	-	-	-	+
17	Control	-	+	+	-
18	Control	-	-	+	-
19	Control	-	+	+	+
20	Control	-	+	+	+
21	Control	-	-	-	-
22	Control	-	+	+	-
23	Control	-	+	+	+
24	Control	+	+	+	-

"+" - Positive for Borrelia Detection

" - " - Negative for Borrelia Detection

DPC is day post challenge

Study I Detection of Borrelia infection by serum antibody profile.

Animal	Treatment Group	-1DPC	28DPC	63DPC	89DPC	118DPC	146DPC
1	SC Vaccinate	-	-	-	+	+	+
2	SC Vaccinate	-	-	+	+	+	+
3	SC Vaccinate	-	-	-	-	-	-
4	SC Vaccinate	-	-	-	-	-	-
5	SC Vaccinate	-	-	-	-	-	-
6	SC Vaccinate	-	-	-	-	-	-
7	SC Vaccinate	-	-	-	-	-	-
8	SC Vaccinate	-	-	-	-	-	-
9	SC Vaccinate	-	-	-	-	-	-
10	SC Vaccinate	-	-	-	-	-	-
11	SC Vaccinate	-	-	-	-	-	-
12	SC Vaccinate	-	-	-	-	-	-
13	Control	-	-	-	-	-	-
14	Control	-	-	+	+	+	+
15	Control	-	-	+	+	+	+
16	Control	-	-	-	-	+	+
17	Control	-	-	-	+	+	+
18	Control	-	-	+	+	+	+
19	Control	-	-	+	+	+	+
20	Control	-	-	+	+	+	+
21	Control	-	-	-	-	-	-
22	Control	-	-	+	+	+	+
23	Control	-	-	+	+	+	+
24	Control	-	-	+	+	+	+

"+" - Antibody positive for presence of *B. burgdorferi* infection
 "- " - Antibody negative for presence of *B. burgdorferi* infection
 DPC is day post challenge

Study II Isolation of *B. burgdorferi* in Skin Samples

Animal	Treatment Group	36DPC	63DPC	91DPC	118DPC	152DPC
1	SC Vaccinate	-	-	-	-	-
2	SC Vaccinate	-	-	-	-	-
3	SC Vaccinate	-	-	-	-	-
4	SC Vaccinate	-	-	-	+	-
5	SC Vaccinate	-	-	-	-	-
6	Control	-	-	+	+	-
7	Control	-	-	-	-	-
8	Control	+	-	+	+	-
9	Control	+	-	+	+	+
10	Control	+	+	-	+	-
11	Control	-	-	+	-	-
12	Control	+	-	+	-	-
13	Control	+	+	-	+	-
14	Control	+	-	+	+	+
15	Control	-	-	+	+	-
16	Control	+	-	+	-	-

"+" - Positive for Borrelia Detection

" - " - Negative for Borrelia Detection

DPC is day post challenge

Study II Detection of *Borrelia* infection by serum antibody profile.

Animal	Treatment Group	0DPC	34DPC	62DPC	90DPC	117DPC	152DPC
1	SC Vaccinate	-	-	-	-	-	-
2	SC Vaccinate	-	-	-	-	-	-
3	SC Vaccinate	-	-	-	-	-	-
4	SC Vaccinate	-	-	+	+	+	+
5	SC Vaccinate	-	-	-	-	-	-
6	Control	-	-	+	+	+	+
7	Control	-	-	-	-	-	-
8	Control	-	-	+	+	+	+
9	Control	-	-	-	+	+	+
10	Control	-	+	+	+	+	+
11	Control	-	-	+	+	+	+
12	Control	-	-	+	+	+	+
13	Control	-	-	+	+	+	+
14	Control	-	-	+	+	+	+
15	Control	-	-	-	+	+	+
16	Control	-	-	-	+	+	+

"+" - Antibody positive for presence of *B. burgdorferi* infection

" - " - Antibody negative for presence of *B. burgdorferi* infection

DPC is day post challenge

Study Type	Safety
Pertaining to	All
Study Purpose	Demonstrate safety of product under typical use conditions
Product Administration	A total of 622 dogs, 217 nine weeks of age or younger, were administered two doses of vaccine, 3 weeks apart, by the subcutaneous route.
Study Animals	Privately owned canines
Challenge Description	NA
Interval observed after challenge	Observed for 30 minutes immediately after first vaccination and then daily for 3 weeks after first vaccination. Observed 30 minutes after second vaccination and then daily for 2 weeks after second vaccination.
Results	Frequency of Events is appended to the end of this summary by Veterinary Dictionary for Drug Related Affairs (VeDDRA) terminology.
USDA Approval Date	July 21, 2016

Summary of Animals Exhibiting Specific Adverse Events at Least once

Veddra Code	Number ≤66 days of age	Percent ≤66 days of age	Number >66 days of age	Percent >66 days of age	Total Number	Percent of all animals
None	190	87.56%	385	95.06%	575	92.44%
Aggression	0	0.00%	1	0.25%	1	0.16%
Skin irritation	0	0.00%	1	0.25%	1	0.16%
Injection site self-trauma	7	3.23%	1	0.25%	8	1.29%
Skin Abscess	0	0.00%	1	0.25%	1	0.16%
Vaginitis	1	0.46%	0	0.00%	1	0.16%
Lymphadenopathy	1	0.46%	0	0.00%	1	0.16%
Maculopapular rash	1	0.46%	0	0.00%	1	0.16%
Death	1*	0.46%	1*	0.25%	2*	0.32%
Sinus Congestion	0	0.00%	1	0.25%	1	0.16%
Lameness	1	0.46%	1	0.25%	2	0.32%
Folliculitis	0	0.00%	2	0.49%	2	0.32%
Otitis externa	0	0.00%	1	0.25%	1	0.16%
Depression	0	0.00%	2	0.49%	2	0.32%
Stranguria	1	0.46%	0	0.00%	1	0.16%
Ocular Discharge	0	0.00%	1	0.25%	1	0.16%
Cough	10	4.61%	0	0.00%	10	1.61%
Anorexia	0	0.00%	1	0.25%	1	0.16%
Decreased Appetite	1	0.46%	1	0.25%	2	0.32%
Diarrhea	3	1.38%	3	0.74%	6	0.96%
Injection site stinging	3	1.38%	1	0.25%	4	0.64%
Gastroenteritis	5	2.30%	4	0.99%	9	1.45%
Injection Site reaction (Swelling < 1 in)	1	0.46%	2	0.49%	3	0.48%
Injection Site reaction (Swelling 1-3 inches)	1	0.46%	1	0.25%	2	0.32%
Injection site Pain	0	0.00%	1	0.25%	1	0.16%

*Deaths confirmed by study cooperator as not attributable to the Vaccine