



Rocky Mountain Spotted Fever and Lyme Disease Surveillance Program in Indiana: Final Report, 1999



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A total of 957 ticks was submitted for testing between January 1 and December 31, 1999. This total is greater than the total for any year since 1991. Mild Spring weather probably contributed to the increase in tick submissions in two ways: ticks became active earlier and people spent more time out-of-doors.

Species Composition

Six species of ticks were identified among the 957 ticks received in 1999 (Table 1). Forty-four percent (418) of these ticks were identified as the American dog tick, *Dermacentor variabilis* (Say). Thirty-four percent (329) were identified as the blacklegged tick (deer tick), *Ixodes scapularis* Say. The lone star tick, *Amblyomma americanum* (L.), made up just over 18% of the total. Together, these three species made up almost 96% of all the ticks received (Figure 1). The other species collected in 1999 (and the number of specimens received) were the winter tick, *Dermacentor albipictus* (Packard)(17), the woodchuck tick, *Ixodes cookei* Packard (9), the brown dog tick, *Rhipicephalus sanguineus* (Latreille) (7). There were six specimens that could not be identified because they were damaged.

Geographic Distribution

Ticks were submitted from 65 of Indiana's 92 counties, six fewer counties than in 1998. Ticks were also submitted from five other states: Illinois (4), Kentucky (17), Ohio (1), Tennessee (1) and Virginia (1). The Indiana counties submitting the greatest number of ticks and the number submitted from each were: Newton (217), Porter (98), Franklin (37) and Lawrence (92), Bartholomew (34), Delaware (34), Lake (26) and Vanderburgh (26). Twenty-seven counties submitted no ticks in 1999. The distribution by county, of ticks submitted in 1999, is shown in Figure 2.

Table 1. Species Composition of Ticks Submitted for Testing in Indiana in 1999

Species	Number	%
<i>Dermacentor variabilis</i>	418	44
<i>Ixodes scapularis</i>	329	34
<i>Amblyomma americanum</i>	171	18
<i>Dermacentor albipictus</i>	17	2
<i>Ixodes cookei</i>	9	1
<i>Rhipicephalus sanguineus</i>	7	0.5
Unidentified ticks/non-ticks	6	0.5
TOTAL	957	100

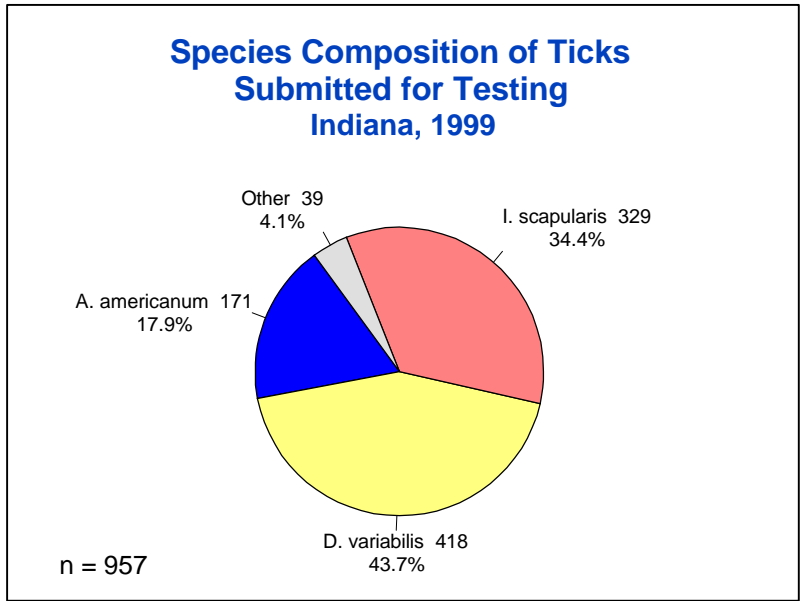
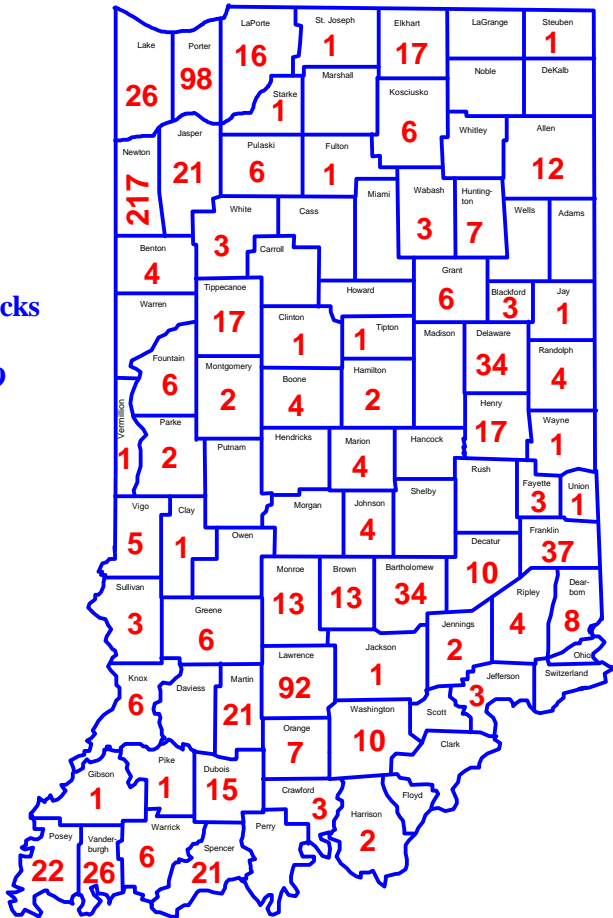


Figure 1

Figure 2
Distribution of Ticks by County of Origin, 1999



Seasonal Distribution

The seasonal distribution for all ticks, by the date of collection, is presented in Table 2. There were two peaks in submissions, one in May, representing *D. variabilis* adults and *A. americanum* adults and nymphs, and one in October, representing *I. scapularis* adults.

Table 2. Monthly Distribution of Ticks Submitted for Testing, Indiana 1999

Month	Number Received
January	1
February	2
March	9
April	154
May	268
June	111
July	76
August	39
September	10
October	219
November	57
December	11
TOTAL	957

The seasonal distribution of ticks is more meaningful when viewed by species. Figures 3-6 depict the seasonal distributions of three species of public health importance (*D. variabilis*, *A. americanum*, and *I. scapularis*) based upon our records of submissions. As usual, *D. variabilis* populations were high during April through July, with the peak of adult activity in May (Figure 3).

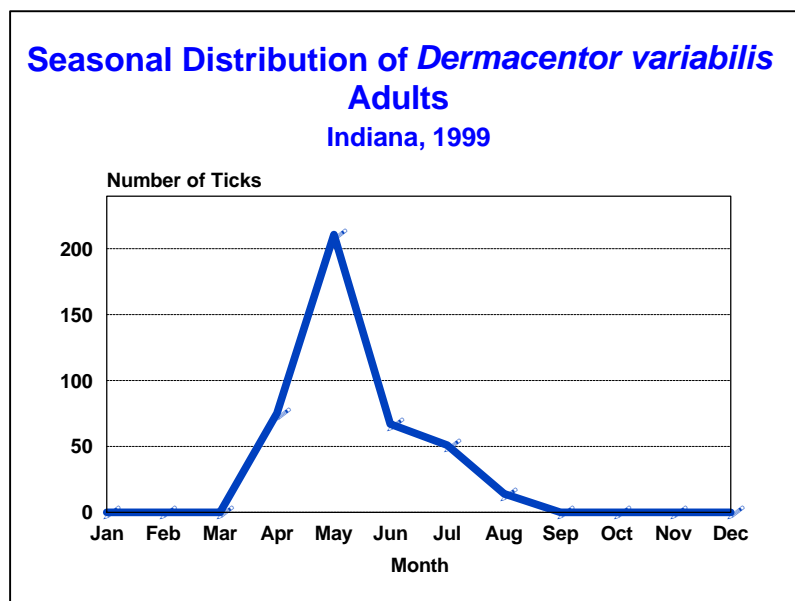


Figure 3

Because of differences in the seasonal activity of adults and nymphs of *A. americanum*, these are displayed in two separate graphs (Figure 4 & 5). In 1999, we received more *A. americanum* adults in April (Figure 4). More *A. americanum* nymphs were collected in May and June and there was a characteristic second, smaller peak in August (Figure 5).

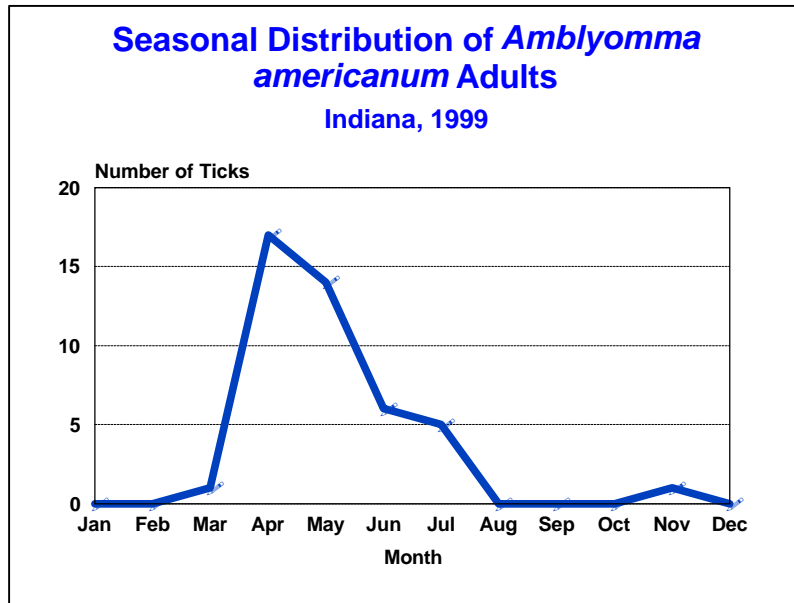


Figure 4

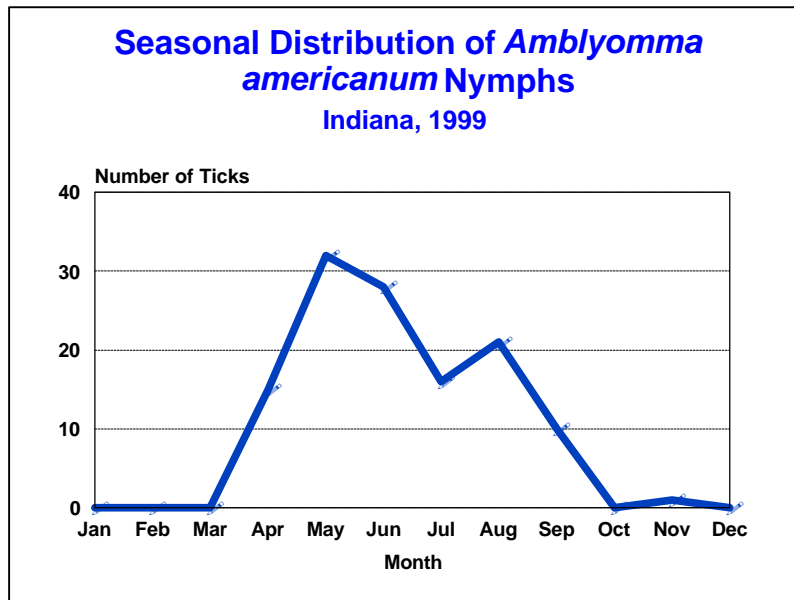


Figure 5

The peak for *I. scapularis* occurred in October when we received 212 ticks, followed by November (45). The next highest month was April with 39 ticks (Figure 6). About 70% (231/329) of the *I. scapularis* ticks were sent to the Lab by Dave Spitznagle who picked them off his dog at the Willow Slough Fish and Wildlife Area in Newton County.

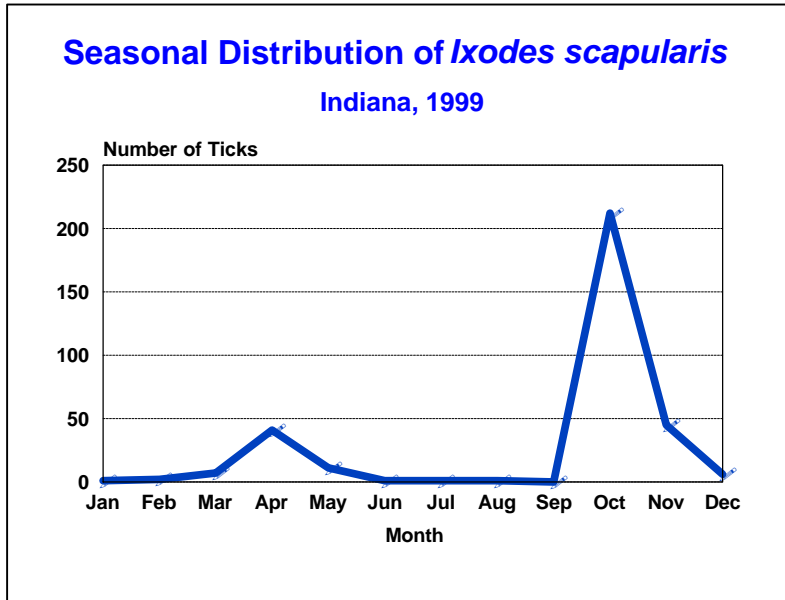


Figure 6

Hosts

In Figures 7-9, host data are presented for *D. variabilis*, *A. americanum*, and *I. scapularis* respectively. Approximately 90% of *D. variabilis* (Figure 7) and 97% of *A. americanum* (Figure 8) were collected from humans in 1999.

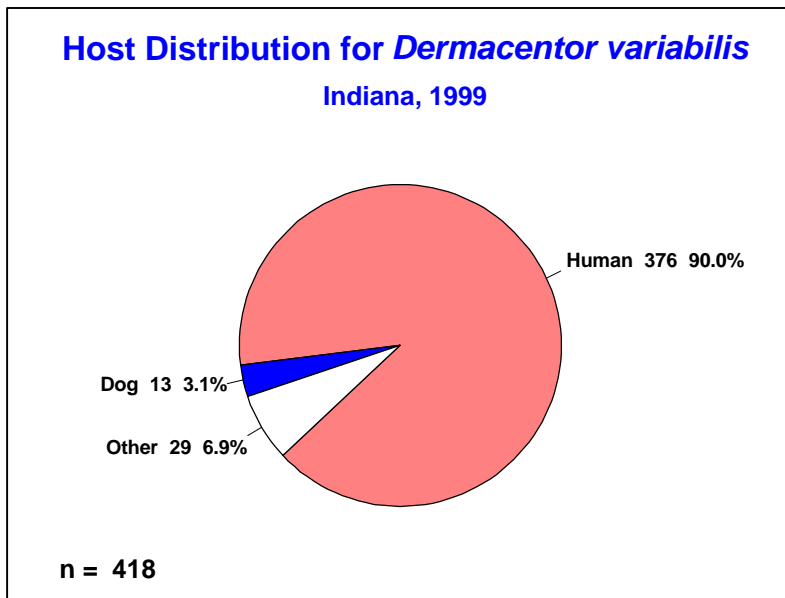


Figure 7

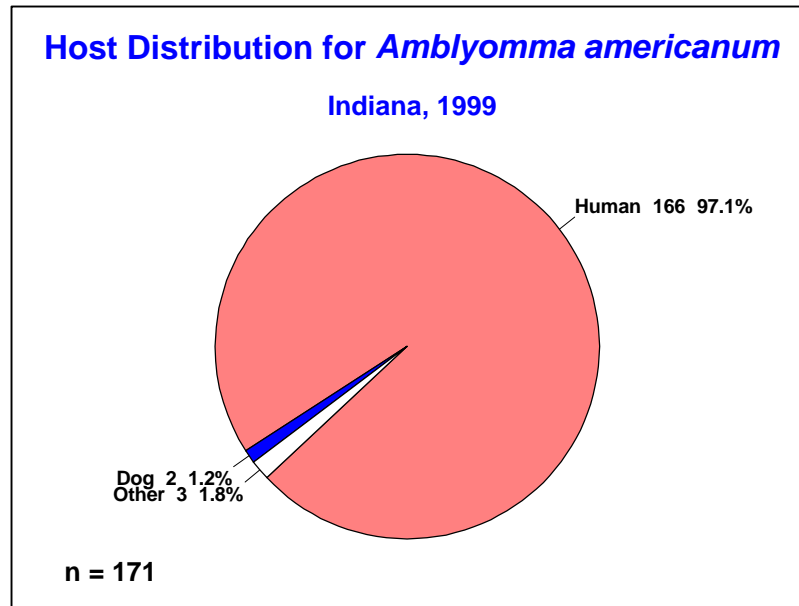


Figure 8

Seventy percent of *I. scapularis* were collected from dogs, about 25% from deer, and nearly 4% (10 ticks) from humans (Figure 9).

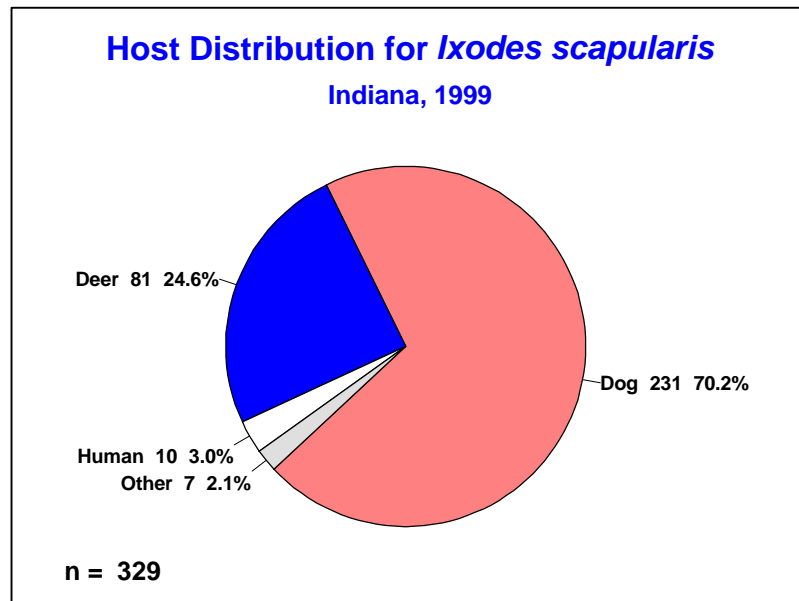


Figure 9

Testing

A total of 310 *D. variabilis* and 74 *A. americanum* were tested for spotted fever group (SFG) rickettsiae. Of these, 34 *D. variabilis* ticks and one *A. americanum* tick were positive by the Gimenez screening test. Six of the *D. variabilis*, positive by Gimenez, were positive by immunofluorescence (FITC). The *A. americanum* tick was negative by FITC. Three *I. scapularis* ticks were tested for Lyme disease spirochetes by fluorescent antibody test; all were negative.

Human Cases of Tick-borne Diseases in Indiana, 1970-1999

Confirmed human cases of known tick-borne diseases in Indiana for 1970-1999 are presented in Table 3. For 1999, 10 cases of RMSF, 13 cases of Lyme disease (LD), and 6 case of human monocytic ehrlichiosis (HME) have been confirmed. The asterisks (*) indicate that the 1999 figures are provisional.

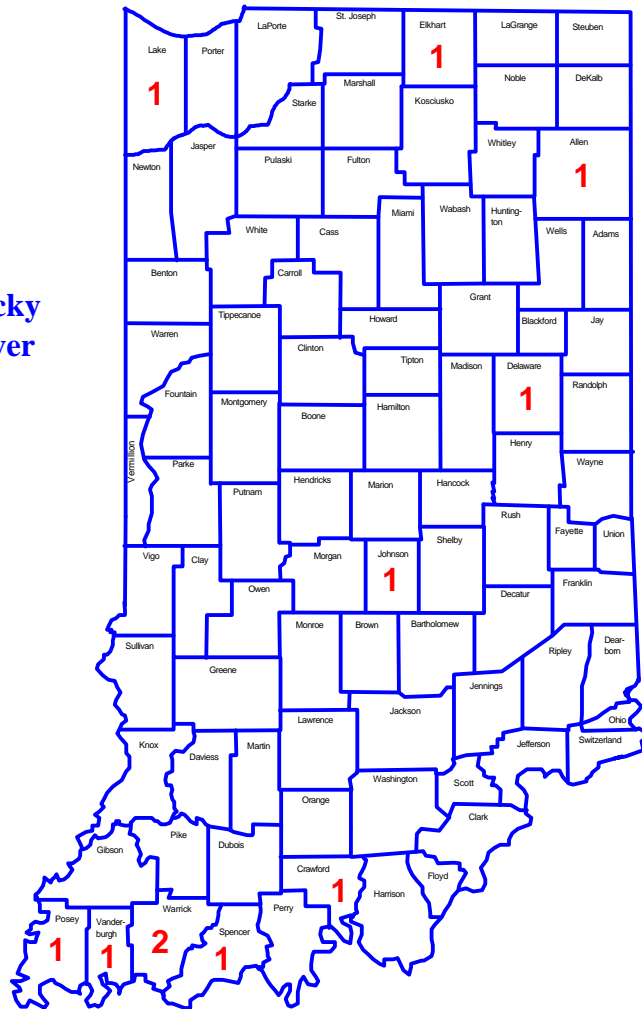
Table 3. Confirmed Cases of Three Tick-Borne Diseases, Indiana, 1970-1999

Year	RMSF	LD	Ehrlichiosis	
			HME	HGE
1970	6	-		
1971	9	-		
1972	13	-		
1973	6	-		
1974	7	-		
1975	5	-		
1976	8	-		
1977	15	-		
1978	6	-		
1979	7	-		
1980	7	-		
1981	6	-		
1982	16	-		
1983	16	2		
1984	7	0		
1985	4	1		
1986	0	0	-	-
1987	3	4	-	-
1988	4	3	-	-
1989	1	4	-	-
1990	7	15	-	-
1991	13	17	-	-
1992	2	19	-	-
1993	3	32	-	-
1994	8	19	5	-
1995	8	16	3	-
1996	7	15	7	-
1997	1	16	2	-
1998	2	22	1	-
1999	*10	*13	*6	-

Rocky Mountain spotted fever (RMSF). *Dermacentor variabilis*, the primary vector of RMSF, has been recorded from all 92 counties in Indiana. Since 1970, 220 confirmed cases of RMSF have been confirmed in Indiana. Although cases have been reported from 60 different counties, more cases have been reported from southern counties than from any other part of the State. Vanderburgh County has reported 45 cases in the past 30 years, far more than any other Indiana County, perhaps in part because it

is recognized as a regional medical center for surrounding counties. A significant number of cases has also been confirmed in residents of the northern-most tier of counties, and the densely populated, Marion County (Indianapolis). The geographic distributions of the ten suspected, probable, and confirmed cases of RMSF for 1999 are shown in Figure 10. These data are provisional.

Figure 10
Reported Cases of Rocky Mountain Spotted Fever
Indiana, 1999

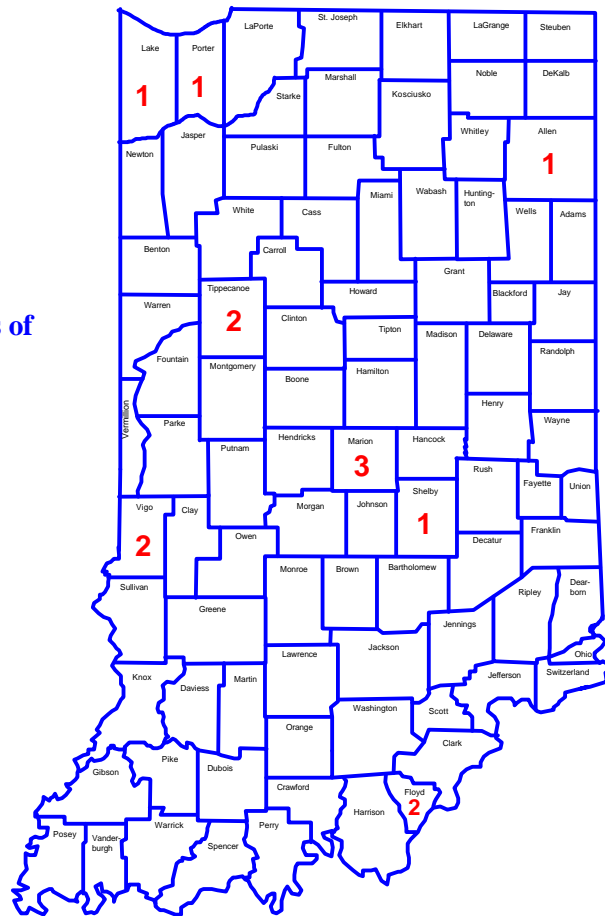


Lyme disease (LD). The first *I. scapularis* ticks collected in Indiana were removed from deer in northwestern counties in 1987 (Pinger and Glancy 1989). The first isolation of *Borrelia burgdorferi* (Johnson et al. 1984) from an Indiana tick was made in 1990 (Pinger et al. 1991). Since then, our laboratory has accumulated additional records of *I. scapularis* adults in Indiana through annual surveys of hunter-harvested deer and a state supported tick testing and surveillance program. For example, in 1998 deer were examined for ticks by more than 28 volunteers staffing 19 deer checking stations in 17 counties and tick mailers were sent to 360 official deer check stations. In summary, 226 ticks were recovered from 52 of 1,167 deer (4.5%) examined in 1998. The percentage of infested deer, 4.5%, was higher than the 1.8% of 1652 deer examined in 1997, the 1.6% of 1,049 deer examined in 1996, and the 1.5% of the 819 deer examined in 1995. Cumulative records reveal that at least one specimen of *I. scapularis* has now been collected from half (46) of Indiana's 92 counties.

In 1993, we discovered the first established, *B. burgdorferi*-infected population of *I. scapularis* ticks in Jasper County, in northwestern Indiana (Pinger et al. 1996). As of July 1999, *Borrelia burgdorferi*-infected populations of *I. scapularis* have been found in four counties in northern Indiana, Newton, Jasper, Pulaski and Porter, and it is probable that populations exist in several of the adjacent counties too.

The first two cases of LD in Indiana were reported in 1983 (Pinger et al. 1989), but investigations of these two cases led neither to additional cases nor to the discovery of tick vectors. The third Indiana case, reported in 1985, led to the eventual discovery of the established population of *I. scapularis* in Jasper County described above (Pinger et al. 1996). During the period 1983-1999, 209 cases of LD have been reported from 59 of Indiana's 92 counties (Indiana State Department of Health, unpublished records). In almost half of these counties, 26, just a single confirmed case has been reported. Figure 11 shows the distribution of the 13 probable and confirmed cases of Lyme disease for 1999. These data are provisional and additional cases are still under investigation.

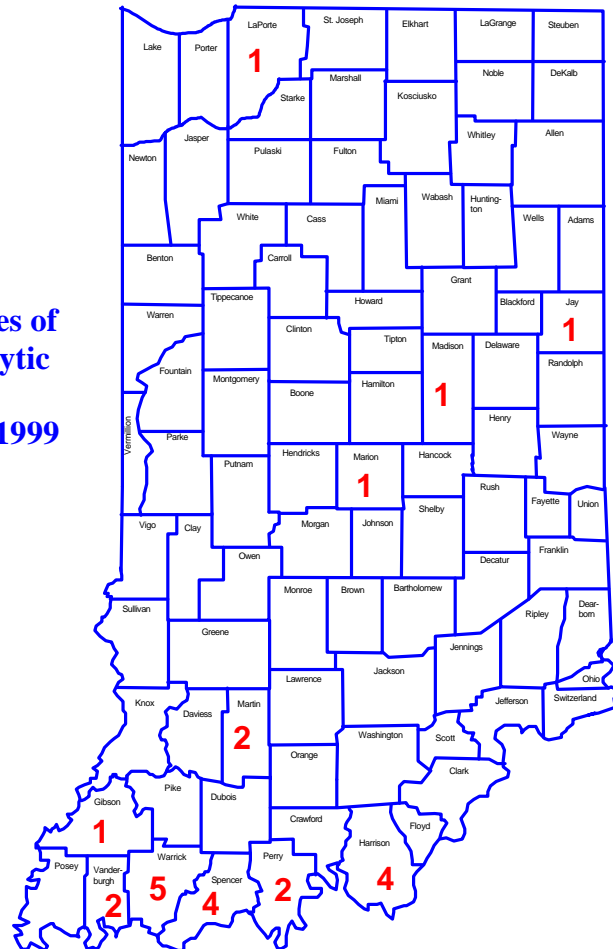
Figure 11
Confirmed Cases of
Lyme Disease
Indiana, 1999



Human monocytic ehrlichiosis (HME). In 1986, the known distribution of *A. americanum* in Indiana was limited to 12 counties in the southern part of the state with an occasional record from a northern county (Demaree 1986). There are now records of *A. americanum* from more than 50 counties, and the populations of this species in some southern counties are extremely high.

In 1994, HME was reported in Indiana for the first time and cases of HME have been confirmed in Indiana each year since (Table 3). As of December 31, 1999, 24 confirmed or probable cases of human HME had been reported (Table 3). The distribution of these cases, with several exceptions, closely follows the distribution of the *A. americanum* tick in Indiana (Figure 12).

Figure 12
Confirmed Cases of
Human Monocytic
Ehrlichiosis
Indiana, 1994 -1999



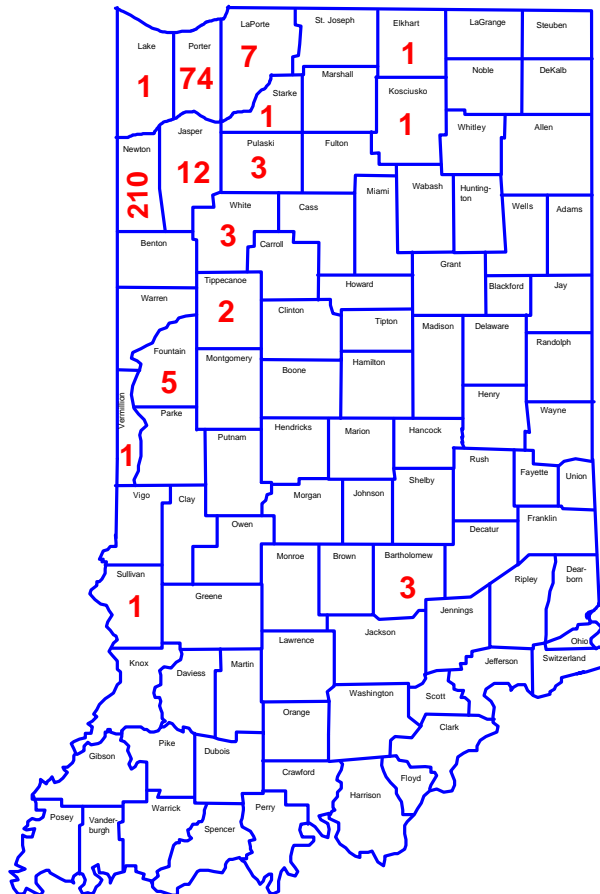
We recently reported relatively high minimal infection rates with *E. chaffeensis* of pools of *A. americanum* ticks collected in 1995 in southern Indiana (Burket et al 1998). The average minimal infection rate observed at that time (4.9%) was somewhat higher than reported for Missouri (1.18%), North Carolina (1.15%), and Kentucky (3.57) (Anderson et al. 1993). To monitor the percentage and stability of *E. chaffeensis*-infected ticks in southern Indiana over time, pools of *A. americanum* ticks were screened for infection in southern Indiana again in 1997 (Steiner et al. 1999). The average minimum infection rate for all sites for 1997 was 1.6% lower than that of 4.9% previously observed for 1995.

To correlate the presence of infected ticks with the presence of exposed deer, which serve as a reservoir, dried blood samples collected from hunter-killed deer at 2 locations in southern Indiana were tested for *E. chaffeensis*-reactive antibodies using an indirect immunofluorescent assay. Antibodies were detected in 45 and 47% of 98 samples examined from the 2 stations. These data provide support to our previous report of a population of *E. chaffeensis* - infected *A. americanum* in southern Indiana and the high proportion of deer previously exposed to *E. chaffeensis* suggests a stable maintenance of *E. chaffeensis* in this tick-vertebrate zoonotic system (Steiner et al. 1999).

Lyme Disease Tick Surveillance in 1999

Each year we pay particular attention to the expanding distribution of *I. scapularis*, the tick that transmits Lyme disease. This tick carries the official common name “blacklegged tick,” but it is sometimes called the deer tick or the Lyme disease tick. This year before we carried out the annual survey of hunter harvested deer, we had already received more than 300 specimens from 15 counties. We continue to receive large numbers of ticks from Dave Spitznagle at Willow Slough FWA in Newton County, and we made a special effort to collect ticks in Porter County. These activities are reflected in the distribution map below. The very large numbers of ticks from these counties does not obscure the fact that the blacklegged tick is spreading eastward and southward from these northwest counties (Figure 13).

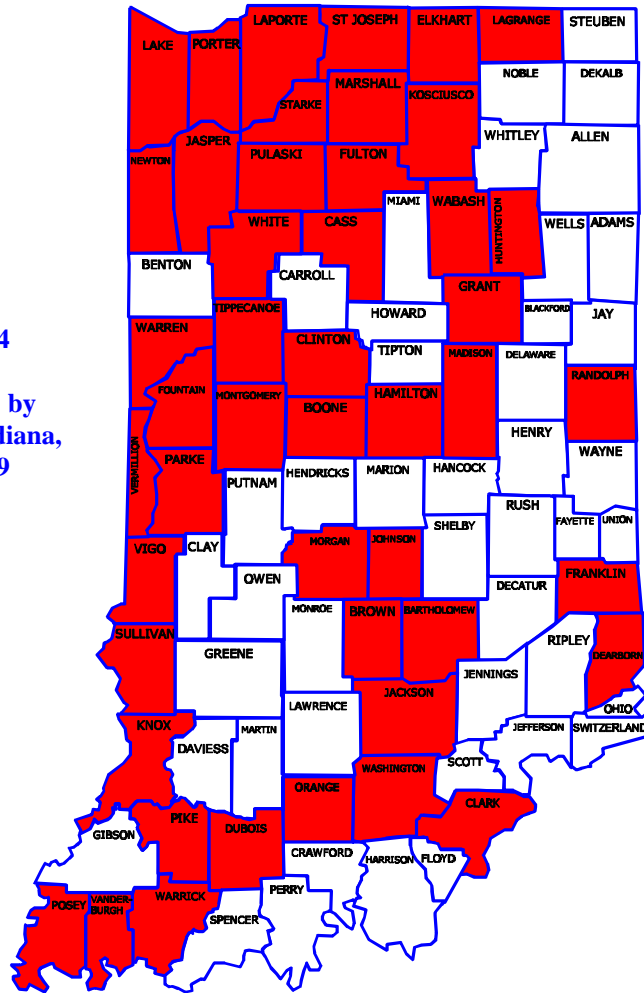
Figure 13
Collections of
Ixodes scapularis
Indiana, 1999



Annual Survey of Hunter-Harvested Deer for Blacklegged Ticks, 1999

Hunter-killed deer were examined for ticks by more than 50 volunteers at 26 deer checking stations in 21 counties. The results of this survey are available in the report, Survey of Indiana Deer for *Ixodes scapularis* Ticks: 1999 Final Report. In summary, an additional 214 *I. scapularis* ticks not included on the map in Figure 13 were recovered from 75 of 1053 deer (7.1%) examined in 1999. This is the highest proportion of positive deer since 1994. Unlike the deer surveys in previous years, no *I. scapularis* ticks were collected on deer from Newton County in 1999. However, ticks were collected from deer killed in 16 Indiana counties including three new counties (Hamilton, Knox and Kosciusko) bringing the number of counties in which infested deer have been found since 1990 to 29. *I. scapularis* ticks were also found on humans from Elkhart and Sullivan Counties in 1999 bringing the total number new county records in 1999 to five, and the number of Indiana counties with at least one *I. scapularis* to 47 (Figure 14).

Figure 14
I. scapularis by
 County in Indiana,
 1987-1999



Conclusions

The number of ticks received in 1999 was the most ticks received since 1991. Six species were identified. *Dermacentor variabilis* made up 44% of the total. *Ixodes scapularis* made up 38%, and *A. americanum* made up 18% of the total. The seasonal distributions of the species of primary interest in this report were similar to those of previous years. Six *D. variabilis* ticks were positive for SFG rickettsiae. None of the *I. scapularis* were positive for *B. burgdorferi*. *Ixodes scapularis* ticks were discovered in five new counties this year bringing the total number of counties from which at least one *I. scapularis* tick has been collected to 47.

Differences remain between the Indiana counties reporting human LD cases and those with known, significant vector populations, a result perhaps of the rural nature of Newton, Jasper and Pulaski Counties. This situation may be changing. With the discovery of *Borrelia burgdorferi*-infected ticks in Porter County this year, greater human exposure to the Lyme disease agent, can be anticipated.

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