



# Rocky Mountain Spotted Fever and Lyme Disease Surveillance Program in Indiana: Final Report, 2000



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Between January 1 and December 31, 2000, 1023 ticks were submitted to the Public Health Entomology Laboratory and Ball State University for identification and testing. This number exceeds last year's total of 957 and is the most ticks submitted since 1991. A mild spring and fall could have contributed to the increase in the number of ticks submitted in 2000.

## Species Composition

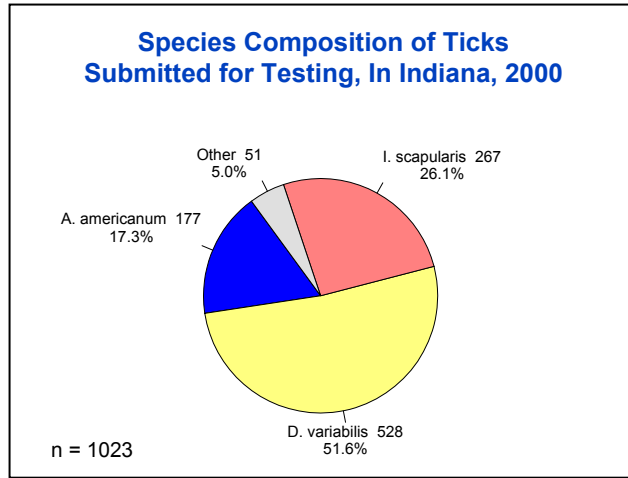
Eight species of ticks were identified among the 1023 ticks received in 2000; these are listed in Table 1. Fifty two percent (528) of these ticks were identified as the American dog tick, *Dermacentor variabilis* (Say), 26% (267) were identified as the blacklegged tick (deer tick), *Ixodes scapularis* Say, and 17% (177) were identified as the lone star tick, *Amblyomma americanum* (L.). Together, these three species made up almost 95% of all the ticks received (Figure 1). The other species collected in 2000 (and the number of specimens received) were the winter tick, *Dermacentor albipictus* (Packard)(6), the brown dog tick, *Rhipicephalus sanguineus* (Latreille) (33), the rabbit tick, *Haemaphysalis leporispalustris* (Packard)(6), the eastern rabbit tick, *I. dentatus* Marx (2), and *I. brunneus* Kock (1). There were three specimens that could not be identified because they were damaged.

**Table 1. Species Composition of Ticks Submitted for Testing in Indiana in 2000**

Species	Number	Percentage
<i>Dermacentor variabilis</i>	528	52
<i>Ixodes scapularis</i>	267	26
<i>Amblyomma americanum</i>	177	17
<i>Dermacentor albipictus</i>	6	1
<i>Haemaphysalis leporispalustris</i>	6	1
<i>Rhipicephalus sanguineus</i>	33	3
<i>Ixodes dentatus</i>	2	<1
<i>Ixodes brunneus</i>	1	<1
Unidentified ticks	3	<1
<b>Total</b>	<b>1023</b>	<b>100</b>

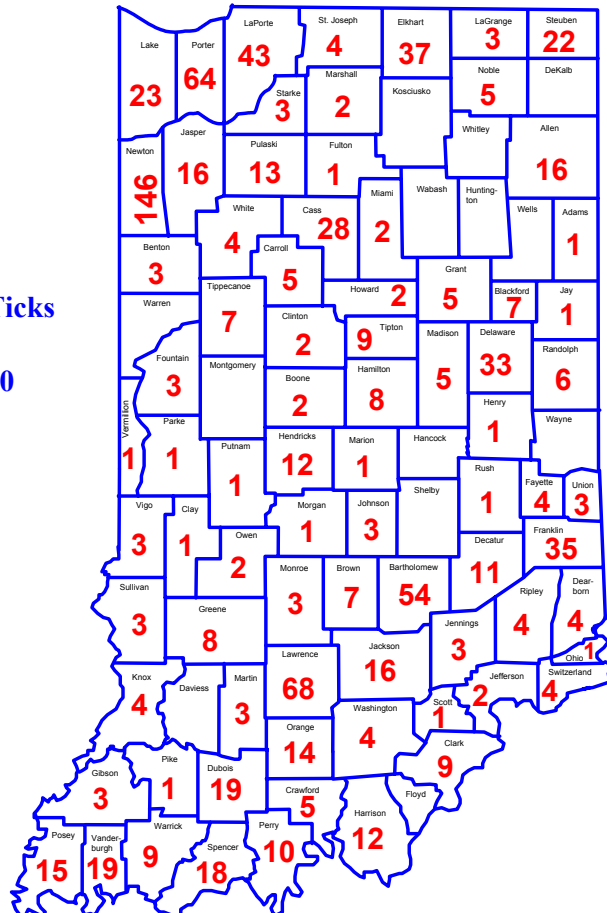
## Geographic Distribution

Ticks were submitted from 79 of Indiana's 92 counties, 14 more counties than were represented in 1999 and 8 more than in 1998. Ticks were also submitted from seven other states: Arkansas (1), Connecticut (1), Illinois (23), Kentucky (2), Michigan (1), New Jersey (1), and Texas (1). The Indiana counties submitting the greatest number of ticks and the number submitted from each were: Newton (146), Lawrence (68), Porter (64), Bartholomew (54), LaPorte (43), Franklin (35), Elkhart (37), Delaware (33), and Cass (28). Thirteen counties submitted no ticks in 2000. The distribution by county, of ticks submitted in 2000, is shown in Figure 2.



**Figure 1. Species Composition of Ticks Submitted for Testing, Indiana, 2000**

**Figure 2**  
**Distribution of Ticks**  
**by County**  
**of Origin, 2000**



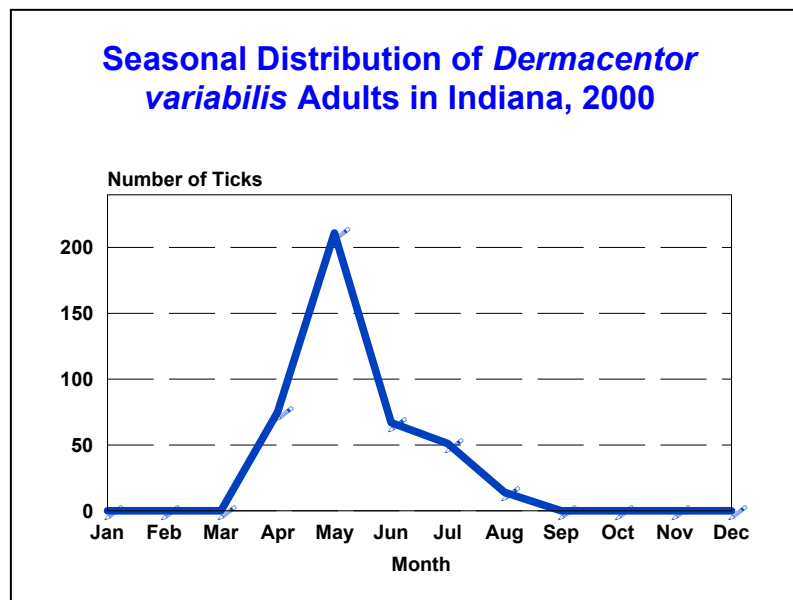
## Seasonal Distribution

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 2000**

Month	Number Received
January	1
February	2
March	34
April	115
May	273
June	125
July	146
August	55
September	23
October	181
November	59
December	9
<b>TOTAL</b>	<b>1023</b>

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**

In 2000, submissions of both adult and nymphal *A. americanum* peaked in May (Figure 4 & 5). There were submissions of *A. americanum* nymphs, throughout the summer with a characteristic second, smaller peak in September (Figure 5).

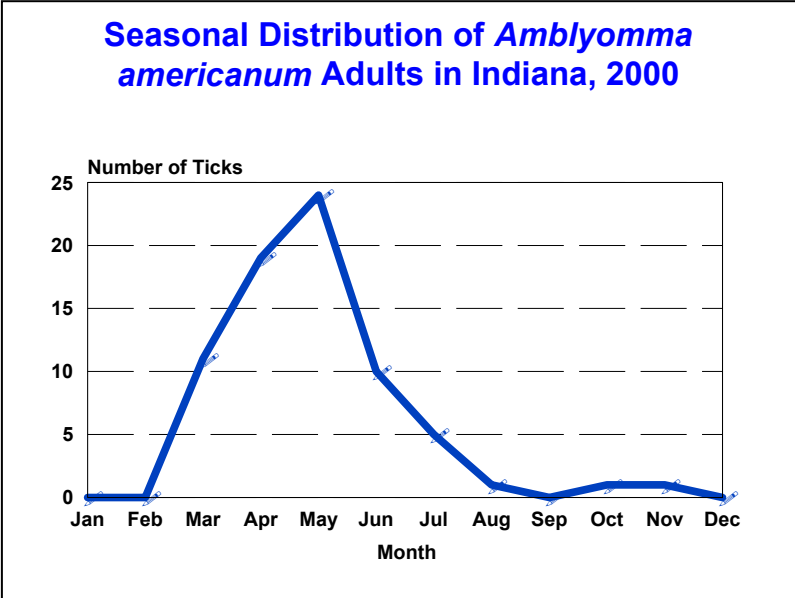


Figure 4

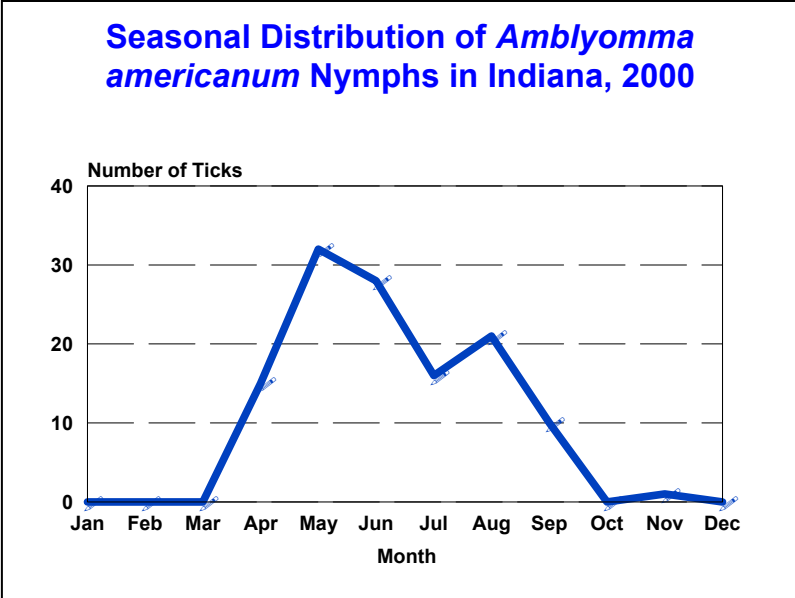


Figure 5

Two peaks are evident for adult *I. Scapularis* in 2000, a small peak in March-April representing over-wintering adults and a large peak October-November representing newly emerged adults (Figure 6). Fourteen nymphs were submitted, seven in May, six in June, and one in July (Figure 7).

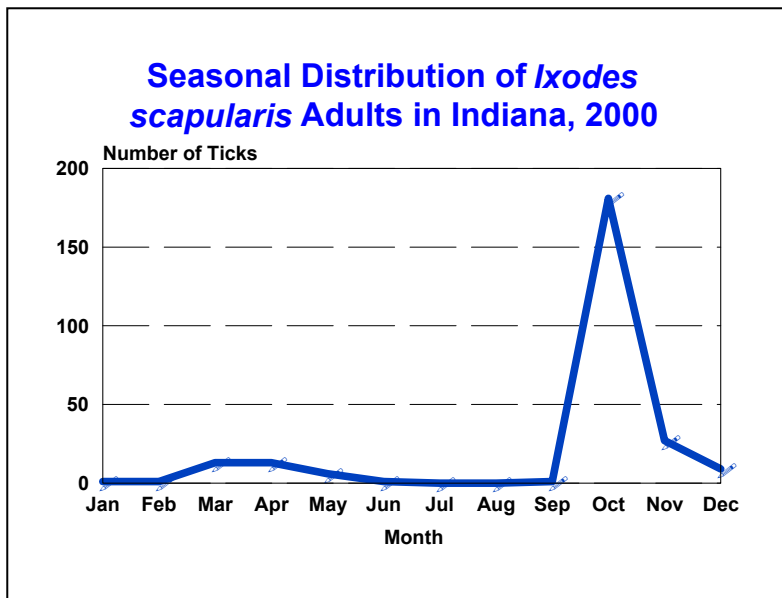


Figure 6

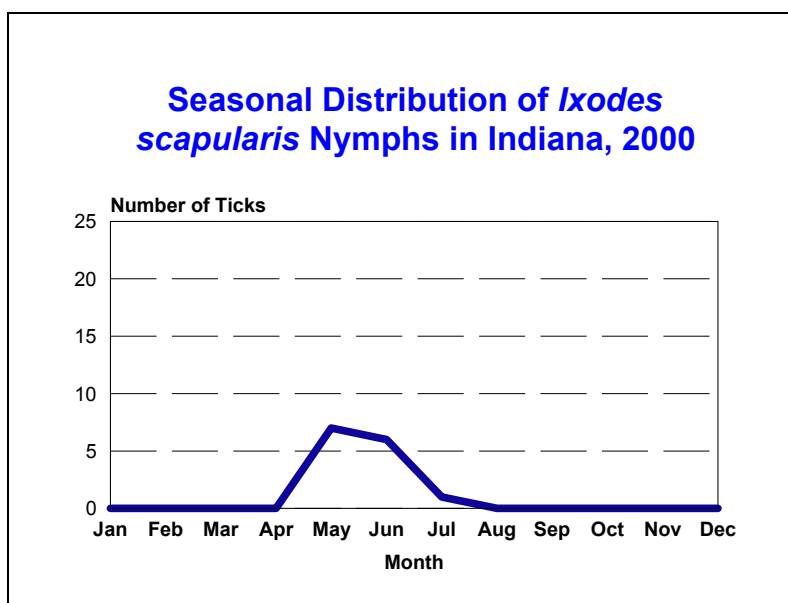


Figure 7

## Hosts

In Figures 8-10, host data are presented for *D. variabilis*, *A. americanum*, and *I. scapularis* respectively. Approximately 86.6% of *D. variabilis* (Figure 8) and 89.3% of *A. americanum* (Figure 9) were collected from humans in 2000.

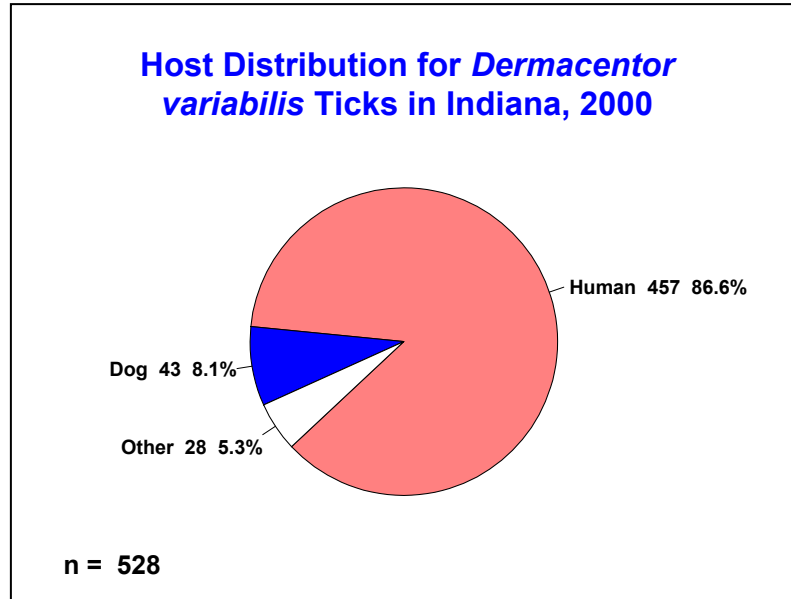


Figure 8

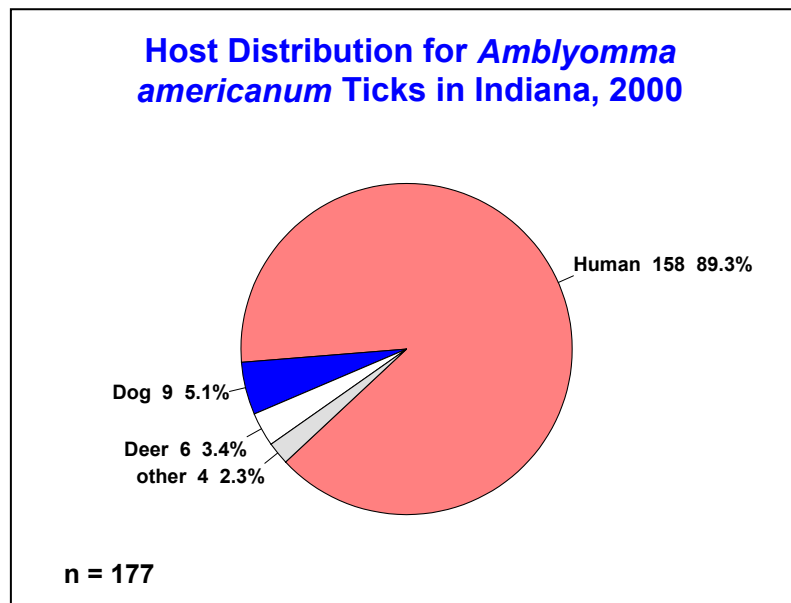
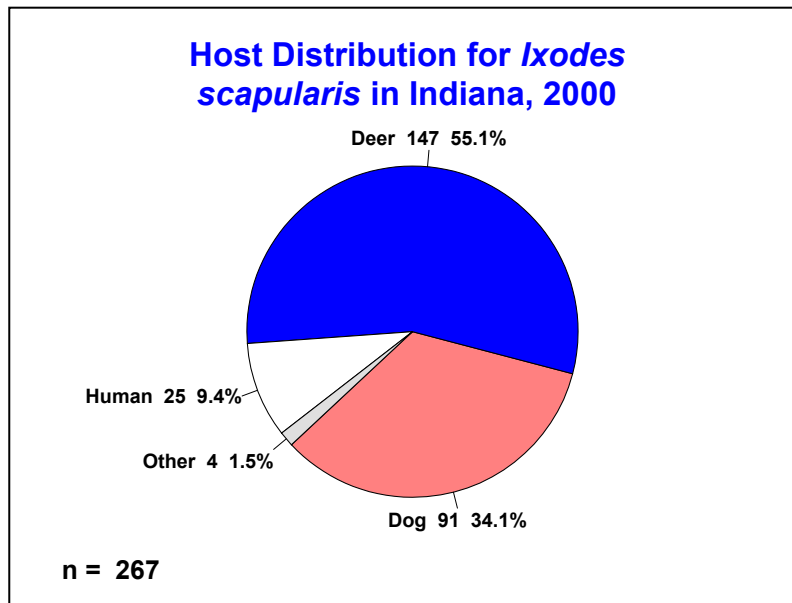


Figure 9

Fifty-five percent of *I. scapularis* were collected from deer, about 34% from dogs, and nearly 9.4% (25 ticks) from humans (Figure 10).



**Figure 10**

## Testing

A total of 315 *D. variabilis* and 85 *A. americanum* were tested for spotted fever group (SFG) Rickettsiae. Of these, 4 of the *D. variabilis* ticks and none of the *A. americanum* ticks were positive by the Gimenez screening test. None of the four *D. variabilis*, positive by Gimenez, were positive by immunofluorescence. Seven *I. scapularis* ticks were tested for Lyme disease spirochetes by fluorescent antibody test; all were negative.

## Human Cases of Tick-borne Diseases in Indiana, 1970-2000

During 2000, 29 cases of tick-borne diseases were confirmed in Indiana, including 5 cases of RMSF, 23 cases of Lyme disease (LD), and 1 case of human monocytic ehrlichiosis (HME). Confirmed human cases of known tick-borne diseases in Indiana for 1970-2000 are presented in Table 3. Asterisks (\*) indicate provisional data.

### Rocky Mountain spotted fever (RMSF)

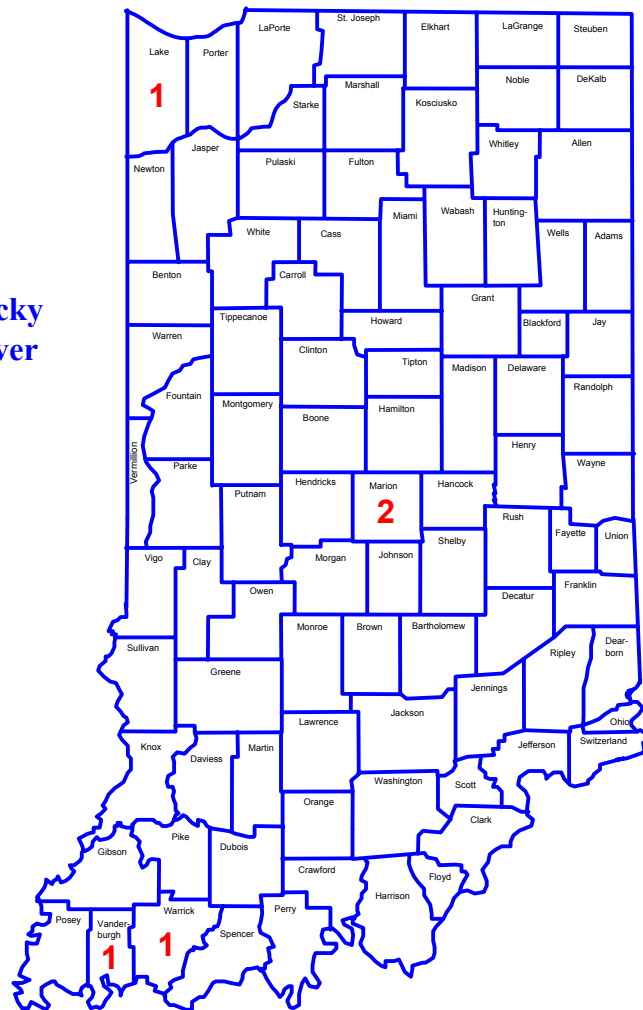
Since 1970, 225 confirmed cases of RMSF have been confirmed in Indiana. Although cases have been reported from 60 different counties, more cases have been reported from southern counties than from any other part of the State. Vanderburgh County has reported 46 cases in the past 31 years, far more than 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 densely populated, Marion County (Indianapolis). *Dermacentor variabilis*, the primary vector of RMSF, has been recorded from all 92 counties in Indiana. The geographic distributions of the five confirmed cases of RMSF for 2000 are shown in Figure 11. These data are provisional.

**Table 3. Confirmed Cases of Three Tick-Borne Diseases,  
Indiana, 1970-2000**

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	-
2000	5*	23*	1*	-

\* Provisional data.

**Figure 11**  
**Reported Cases of Rocky Mountain Spotted Fever in Indiana, 2000**

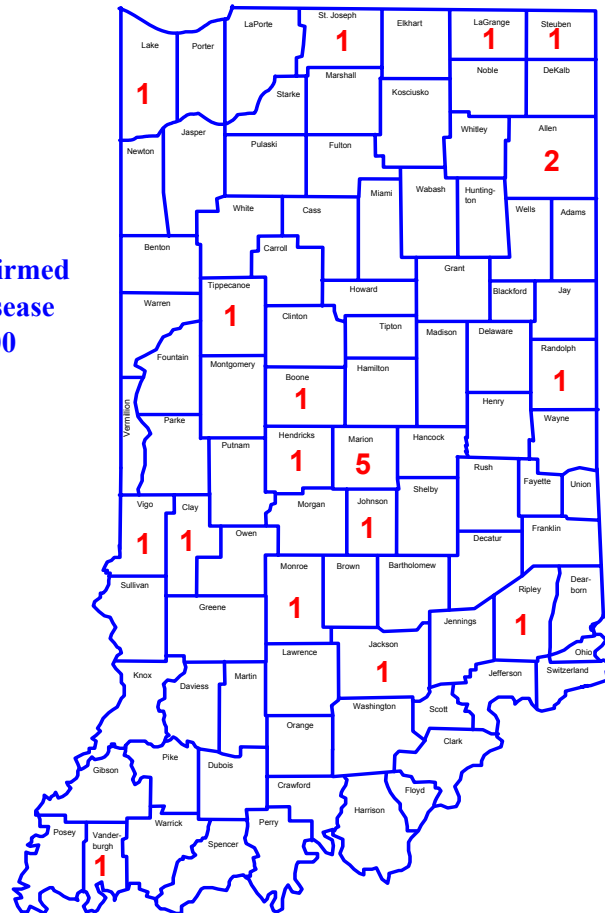


### Lyme disease (LD)

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 1983-2000, 232 cases of LD have been reported from 63 of Indiana's 92 counties (Indiana State Department of Health, unpublished records). In almost half of these counties, 30, just a single confirmed case has been reported. Figure 12 shows the distribution of the 23 probable and confirmed cases of Lyme disease for 2000. These data are provisional and additional cases are still under investigation.

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. Through December 31, 2000, at least one *I. scapularis* tick has been collected in 53 of Indiana's 92 counties. *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.

**Figure 12**  
**Probable and Confirmed**  
**Cases of Lyme Disease**  
**in Indiana, 2000**



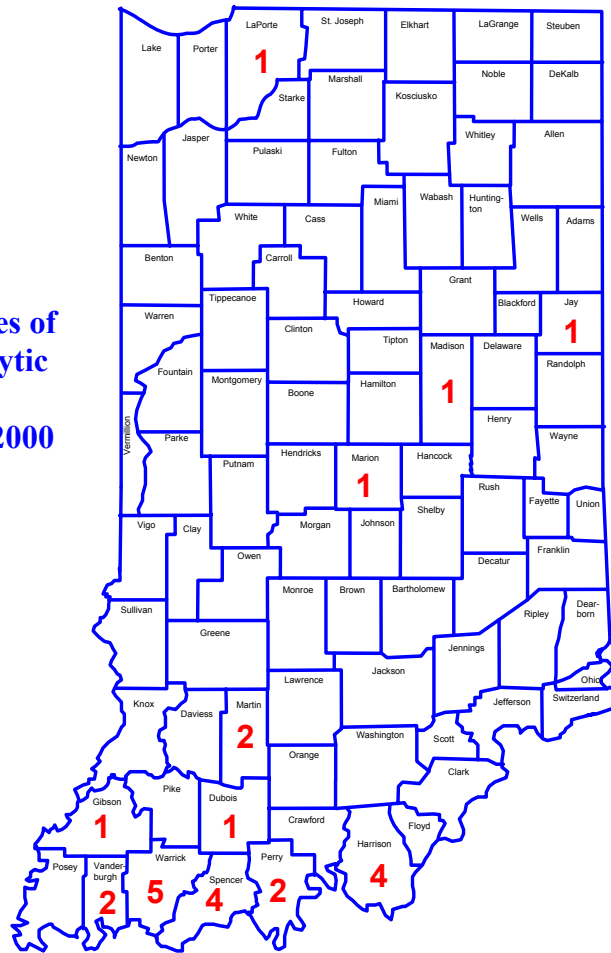
### Human monocytic ehrlichiosis (HME)

In 1994, HME was reported in Indiana for the first time and cases of HME have been confirmed in Indiana each year since. As of December 31, 2000, 25 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 13).

In 1986, the known distribution of *A. americanum*, the tick vector of human monocytic ehrlichiosis (HME) 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.

We have previously reported *E. chaffeensis* infection rates in *A. americanum* ticks collected in southern Indiana (Burket et al. 1998, Steiner et al. 1999 and Irving et al. 2000). The average minimal infection rate observed in our studies ranged from 1.6%–4.9% for positive counties. To correlate the presence of infected ticks with the presence of exposed deer, which serve as a reservoir, we collected dried blood samples collected from hunter-killed deer and tested them for *E. chaffeensis*-reactive antibodies using an indirect immunofluorescent assay. Antibodies were detected in deer from six counties in southern Indiana and the infection rates in these deer ranged from 42%–66% (Steiner et al. 1999, Irving et al. 2000).

**Figure 13**  
**Confirmed Cases of**  
**Human Monocytic**  
**Ehrlichiosis**  
**Indiana, 1994 -2000**



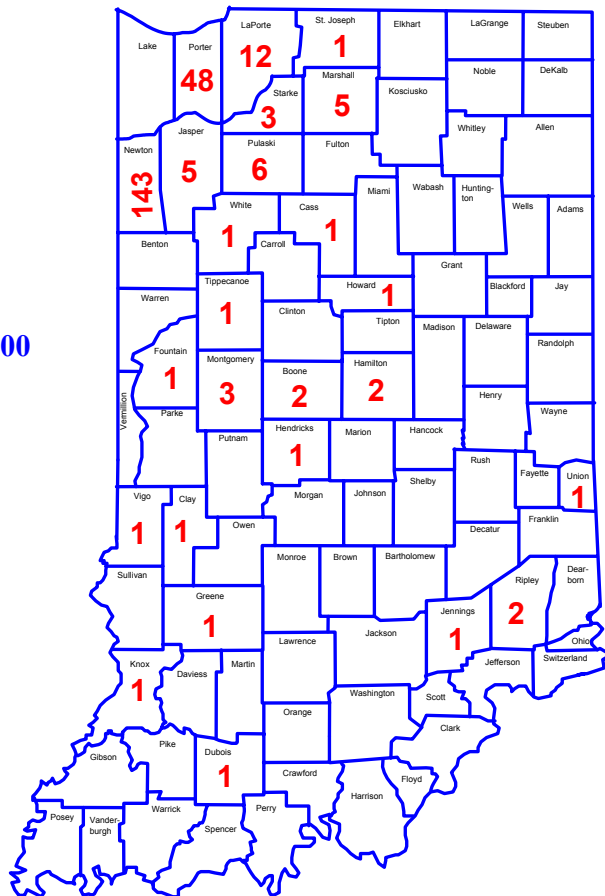
## Surveillance for the Blacklegged Tick (Lyme Disease Tick) in 2000

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 we received specimens from 15 counties. While we continue to receive large numbers of ticks from Dave Spitznagle at Willow Slough FWA in Newton County, but this year more of these ticks were collected from deer. Most of the Porter County ticks came from dogs and humans. The blacklegged tick is spreading eastward and southward from these northwest counties and is being found increasingly in the central part of the state (Figure 14).

## Annual Survey of Hunter-Harvested Deer for Blacklegged Ticks, 2000

Hunter-killed deer were examined for ticks by more than 24 volunteers at 21 deer checking stations in 21 counties. The results of this survey are available in the report, Survey of Indiana Deer for *Ixodes scapularis* Ticks: 2000 Final Report. In summary, 32 *I. scapularis* ticks were recovered from 28 of 771 deer (3.63%) examined in 2000. These 32 ticks have been included on the map in Figure 14. These ticks were collected from deer killed in 16 Indiana counties including six new counties (Green, Howard, Jennings, Marshall, Ripley and St. Joseph) bringing the number of counties in which infested deer have been found since 1990 to 35. An *I. scapularis* tick was also found on a human from Hendricks County in 2000 bringing the total number new county records to six, and the number of Indiana counties with at least one *I. scapularis* to 53 (Figure 15).

**Figure 14**  
**Collections of**  
***Ixodes scapularis***  
**Ticks in Indiana, 2000**



## Conclusions

The number of ticks received in 2000 was the most ticks received since 1991. Eight species were identified. *Dermacentor variabilis* made up 52% of the total. *Ixodes scapularis* made up 26%, and *A. americanum* made up 17% of the total. The seasonal distributions of the species of primary interest in this report were similar to those of previous years. Rickettsiae were detected in four *D. variabilis* ticks, but these ticks were negative for SFG Rickettsiae. None of the seven *I. scapularis* tested for *B. burgdorferi* were positive. *Ixodes scapularis* ticks were discovered in six new counties this year bringing the total number of counties from which at least one *I. scapularis* tick has been collected to 53.

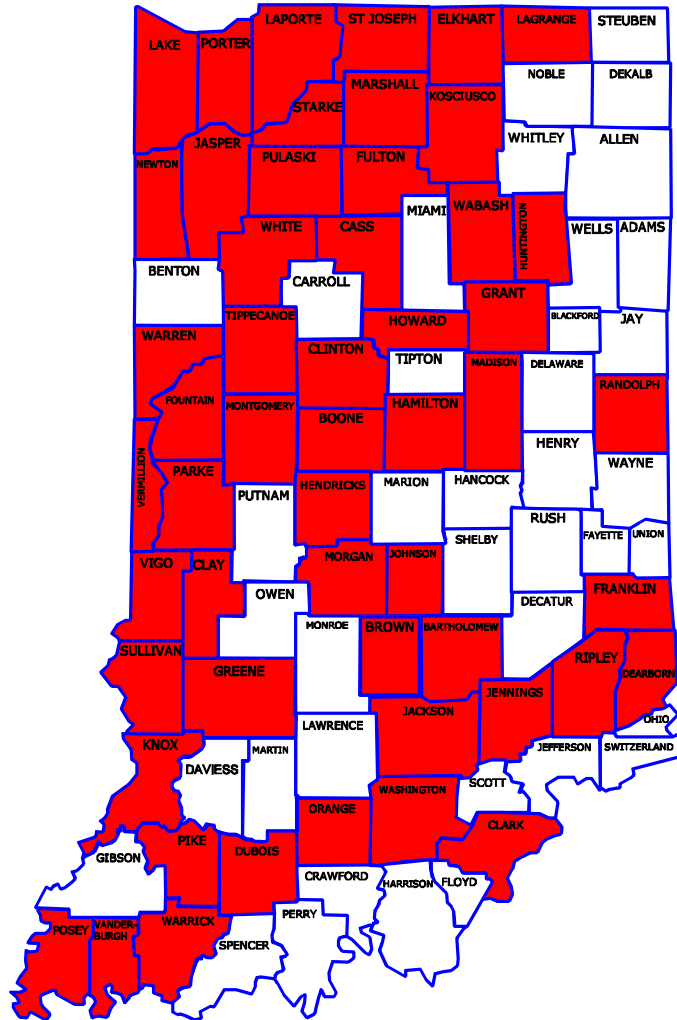


Figure 15. Distribution of *Ixodes scapularis* in Indiana, 1987-2000

## Acknowledgments

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