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RED IMPORTED FIRE ANTS (HYMENOPTERA: FORMICIDAE): FREQUENCY OF STING ATTACKS ON RESIDENTS OF SUMTER COUNTY, GEORGIA

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Abstract. A survey of the human sting attack rate of the red imported fire ant, *Solenopsis invicta*, on a sample population in Sumter Co., Georgia, USA, was conducted over a 12-month period. Seventy-seven families (310 individuals) initially participated in the program, but dropouts reduced the average study population to 272 individuals per month. A total of 213 sting attacks were recorded for 95 individuals. A majority (179) of these were recorded for rural residents. The greatest contact occurred from April to September, with the total sting attacks ranging from 18-35 per month. The highest sting attack rate occurred in persons under 20 years of age (50%); the number of stings declined with increased age. Females reported being stung at a slightly higher rate than males. Two individuals (1%) classified their sting reactions as severe, 26 (12%) as moderate, and 183 (87%) as mild.

The medical impact of stings of the red imported fire ant (RIFA), *Solenopsis invicta* Buren, has been the subject of numerous investigations, particularly with respect to the systemic effects of the venom. Lockey (1974) reviewed the literature and presented an informative description of the sequence of events that occur following a sting. These include an initial intense burning sensation followed by the formation of a wheal, which may become as large as 10 mm in diameter. A vesicle containing clear fluid forms at the sight of the sting in about 4 h. Subsequently the fluid becomes cloudy, and after 24 h a white pustule, which is characteristic of a RIFA sting, has formed. The sterile pustule remains for 3 to 10 days before rupturing, after which a small scar may be noticeable at the sting site. If the pustule breaks, secondary infections may occur. Occasionally, a severe systemic reaction may follow the stinging incident, which can result in anaphylactic shock and death unless medical attention is obtained promptly.

The venom of the red imported fire ant is composed primarily of alkaloids (2-6 disubstituted piperidines), a unique composition since most insect venoms are proteinaceous (MacConnell et al. 1970, Brand et al. 1972). However, the venom contains

a small aqueous component (<5%), and Baer et al. (1979) demonstrated the presence of 3 allergenic proteins in this fraction. The extreme potency of these antigens is of particular interest. Rhoades et al. (1978) state that less than 1% of the average sting volume (0.07-0.10 μ l) is composed of protein, while the average bee sting contains 50 μ g of dried protein (Rhoades et al. 1978).

No good estimates is presently available of either the number of individuals who are stung each year by RIFA or the percentage of those stung who have systemic reactions. Rhoades et al. (1975, 1977) reported systemic reactions in 49 cases and 104 cases, respectively. In an earlier study, 1020 physicians in South Carolina, queried about treatment of patients afflicted with fire ant stings, reported treating 1088 cases from 1970 to 1972. These included 69 cases of anaphylactic shock, with 333 lesser allergic reactions and 145 with secondary infections (Lawrence et al. 1973).

These medical records reinforce the conclusion that RIFA are a definite medical problem in the South. However, it is impossible to determine the extent of the problem without data on sting rates in relation to the numbers of people suffering systemic reactions. A study of this type was conducted by Clemmer & Serfling (1975) in a suburban area of New Orleans, Louisiana. They surveyed 240 households by telephone; 29% of the study population reported stings (June to August 1973) with 55% of the stings occurring among children under 10 years of age. Minimal allergic reactions were reported for 17% of the victims, and 4.4% required medical consultation.

In an effort to provide additional information on this problem, we obtained the collaboration of the county health officials in 2 counties in Georgia to conduct similar surveys. The results of the 1st of these surveys were reported by Yeager (1978). He sampled 156 families (72 rural and 84 urban) for 1 year in Lowndes Co., Georgia, including the county seat, Valdosta. He concluded that out of a random sample of 5 people, the odds are better

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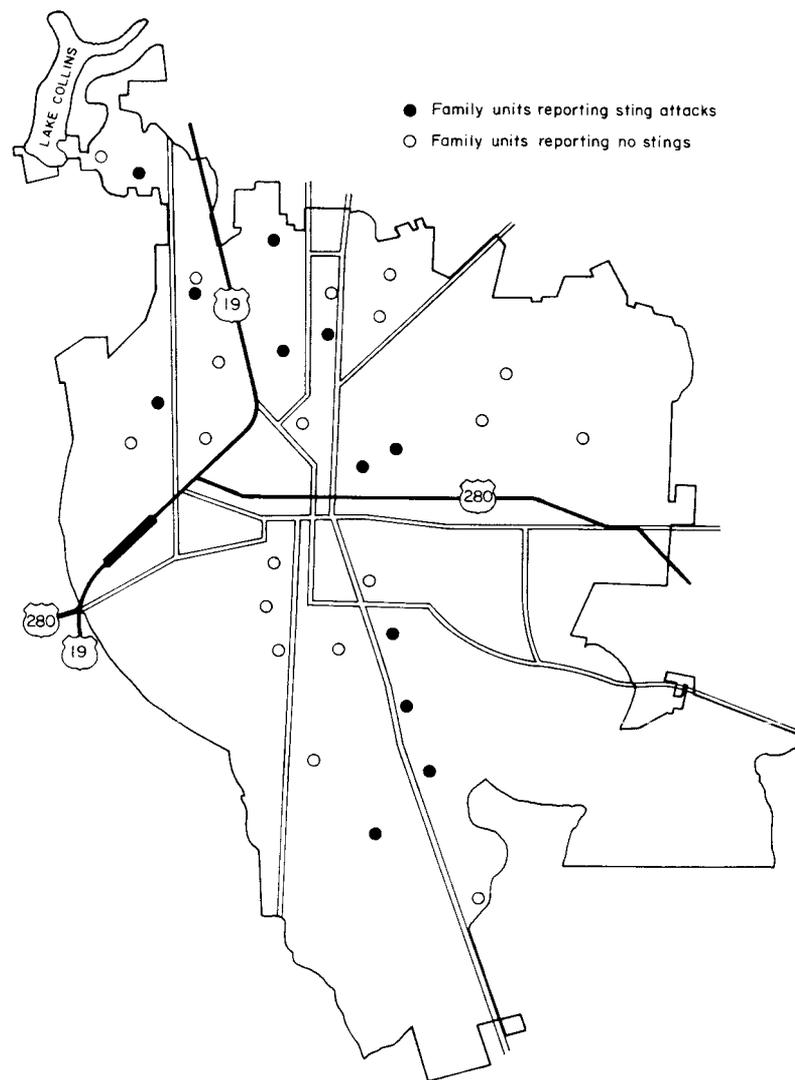


FIG. 1. Map of Americus, Georgia, indicating location of urban family units participating in sting attack survey of the red imported fire ant.

than even that 1 will be stung each month. Attack rates were higher in the summer months, as would be expected. The 2nd study is the subject of this report.

MATERIALS AND METHODS

This 2nd study was conducted in Sumter Co., Georgia, a predominantly rural county moderately to heavily infested with RIFA, with 20 to 326 mounds per ha in rural areas and 20 to 85 mounds per ha in Americus, the principal city and county seat. The study was conducted in cooperation with the Sumter Co. Health Department in Americus (Mr Ray Billings, Director).

Sumter Co. is located in west-central Georgia on the lower reaches of the Piedmont. Its economy is predominantly agricultural. Americus is the larg-

est city (pop. ca. 17,000), with the total county population in 1976 estimated at 29,000. Other towns in the county include Plains, Andersonville, Leslie, and DeSoto, with a total combined population of ca. 1800. For the purposes of this study, all persons living outside of Americus were considered rural.

Family units representing about 1.34% of the total in the county were selected randomly using a modified grid/concentric circle technique. The ratio of rural:urban families was 46:31, in keeping with the proportions in the county. The race of the respondents was not considered in the selection process. A presurvey was conducted by trained interviewers who personally visited each of the family units in December 1975. Respondents were informed that all contacts would be made by telephone during the 1st 10 days of each month.

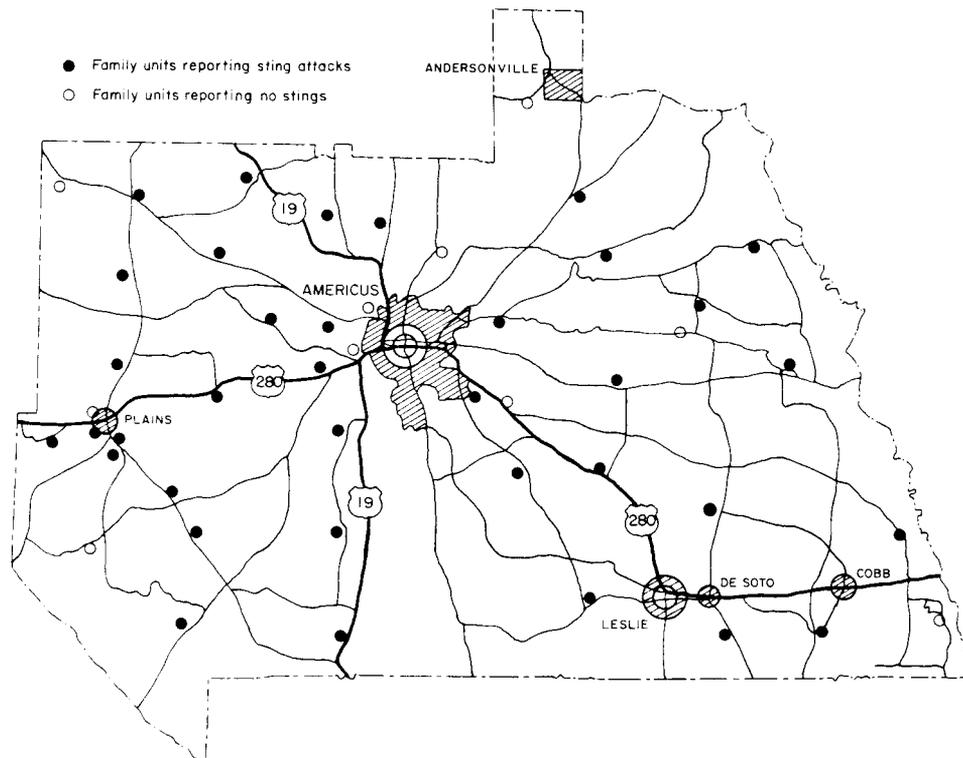


FIG. 2. Map of Sumter Co., Georgia, indicating location of rural family units participating in sting attack survey of the red imported fire ant.

At that time they were to report all fire ant sting attacks for the family for the preceding month, referring to the sting victims only by sex and age, thus adhering to the "right-of-privacy" act relating to survey respondents. All telephone contacts were made by trained interviewers who were members of the staff of the Sumter Co. Health Department.

Additionally, forms for reporting fire ant-related visits were distributed to members of the Sumter Co. Medical Society, and to the emergency room of the local hospital, all of whom agreed to participate in the study. Forms were collected by members of the staff of the health department during the 1st 10 days of each month.

RESULTS

Seventy-seven family units (310 individuals) with 1 to 10 individuals per unit initially agreed to participate in the study. Because of dropouts during the year, our study population declined to 62 family units (254 individuals) by the close of the study (Fig. 1, 2.) The average study population for the year was 271.7 individuals/month. The 2nd quarter showed the greatest loss of respondents [9 family units (43 individuals)]. Only 10 individuals failed to report after July 1.

A breakdown of the study population by age and sex is given in Table 1. The division of age groups was patterned after that used by Clemmer & Serfling (1975) so that direct comparisons could be made with their data. The survey group was composed of 161 females and 149 males. Approximately 50% of each sex category were less than 20 years old, ca. 30% were between 20 and 44 years old, and the remainder were older than 44.

A total of 213 sting attacks on 95 of the 310 persons who participated in all or part of the survey were recorded (Table 2). As expected, the vast majority occurred among rural residents, with 179 attacks on persons from 46 families (Fig. 1). Thirty-one urban residents from 12 families were stung (Fig. 2). The greatest contact with the ants occurred from March to September, with total sting attacks per month ranging from 18 to 35. In most months there were individuals who reported more than 1 attack. Interestingly, most of the multiple sting reports occurred during the spring (March-May), when farmers and gardeners were most active in preparing land for new crops. Whereas more rural people received stings, a greater percentage of urbanites reported multiple stings (26 vs. 18%).

TABLE 1. Numbers, age, and sex of survey participants who were stung by red imported fire ants at least once during 1976.

AGE GROUP (YEARS)	♂			♀			TOTALS		
	NO. IN AGE GROUP	PERSONS STUNG		NO. IN AGE GROUP	PERSONS STUNG		NO. IN AGE GROUP	PERSONS STUNG	
		No.	%		No.	%		No.	%
0-4	13	3	23	17	9	53	30	12	40
5-9	19	7	37	25	12	48	44	19	43
10-14	24	8	33	17	4	24	41	12	29
15-19	18	4	22	17	6	35	35	10	29
20-44	43	13	30	52	14	27	95	27	28
45-64	22	4	18	21	6	29	43	10	23
65+	10	3	30	12	2	17	22	5	23
Total	149	42	28	161	53	33	310	95	31

Slightly more females reported 1 or more sting attacks than males (33 vs. 28%) (Table 1). This resulted primarily from a high sting rate in girls 0 to 10 years old. If we consider all the participants less than 20 years old, 31 (41%) of the females reported stings compared to 22 (30%) of the males. In the middle age range (20 to 44) and in those over 44, the percentage of men and women reporting an attack was about equal (30 vs. 27% and 22 vs. 24%, respectively).

The data for total stings show a definite trend toward less exposure with increasing age, with individuals over 45 being about half as likely to be stung as those under 10.

Of the 42 males reporting sting attacks, 24 were stung once, 6 twice, and 12 were stung 3 or more times. One elderly male reported 15 separate sting

encounters during the year. Thirty-four of 53 females were stung once, compared to 12 and 7 with 2 or 3+ attacks, respectively. The greatest percentage of multiple attacks (14%) occurred in the 5 to 9, 20 to 44, and 45 to 64 age groups (Table 3).

When asked to classify their sting attacks as mild, moderate, or severe, only 2 individuals considered their reactions severe (1%); 26 (12%) said they had a moderate reaction, and 183 (87%) a mild reaction.

Our attempt to obtain a record of all individuals reporting to physicians or hospitals for treatment of arthropod bites or stings was not successful. We did not receive any reports after June, and it was obvious that we did not receive complete cooperation during the 1st 6 months. Altogether we obtained 14 reports of cases treated from February through June. Seven cases involved imported fire ant stings, 3 were spider bites and 1 was a mos-

TABLE 2. Frequency of red imported fire ant sting attacks among urban and rural residents of Sumter Co., Georgia (1976).

MONTH	NO. OF STING ATTACKS*		
	URBAN	RURAL	TOTAL
Jan.	0	3 (3)	3 (3)
Feb.	1 (1)	6 (6)	7 (7)
Mar.	6 (5)	20 (16)	26 (21)
Apr.	8 (4)	16 (11)	24 (15)
May	6 (4)	29 (19)	35 (23)
Jun.	1 (1)	24 (22)	25 (23)
Jul.	4 (2)	14 (14)	18 (16)
Aug.	2 (2)	23 (21)	25 (23)
Sep.	3 (3)	22 (17)	25 (20)
Oct.	2 (2)	12 (10)	14 (12)
Nov.	1 (1)	7 (6)	8 (7)
Dec.	0	3 (1)	3 (1)
Totals	34 (25)	179 (146)	213 (171)

* Since some individuals reported more than 1 sting attack during a month, the number in () indicates number of individuals reporting stings.

TABLE 3. Number of individuals receiving single or multiple sting attacks by red imported fire ants.

NO. OF STING ATTACKS	AGE GROUPS							
	0-4	5-9	10-14	15-19	20-44	45-64	65+	TOTAL
♂ (42)								
1	3	5	5	4	6	1	0	24
2	0	1	1	0	2	1	1	6
3+	0	1	2	0	5	2	2	12
♀ (53)								
1	6	8	3	4	8	3	2	34
2	3	2	1	2	3	1	0	12
3+	0	2	0	0	3	2	0	7
Total (95)								
1	9	13	8	8	14	4	2	
2	3	3	2	2	5	2	1	
3+	0	3	2	0	8	4	2	

quito or yellow fly (tabanid) bite. In the 3 remaining cases, the arthropod that inflicted the sting or bite was listed as unknown. Five of the RIFA cases were reported during the month of February.

DISCUSSION

Compared to the survey of Clemmer & Serfling (1975), our survey population included a larger number of persons less than 20 years old (ca. 10%), which was compensated for by fewer persons older than 44. This probably reflects the difference between a suburban, middle income population in Metairie, Louisiana, and a predominantly rural population in Sumter Co., Georgia, that included many families in the lower income strata. Clemmer & Serfling reported that 28.6% of their respondents were stung 1 or more times during the months of June, July, and August. During the same time period, 23% of our respondents reported stings. The period of greatest sting attacks in our survey was during the months of April, May, and June, when 28% reported 1 or more attacks. No documentable explanation for the difference in peak time of sting attacks is apparent; however, Yeager (1978) also reported a high attack rate for urbanites during the 3rd quarter of 1976 (July–September). Thus, since the highest attack rate is on children, this may reflect increased summer activity of city dwellers when children are not in school.

The attack rates for the various age classes of Clemmer & Serfling (1975) compared favorably with our data, except that they found that 54% of male children under 15 years of age were stung compared to only 32% in our study. In contrast, the sting rate in our study for individuals over age 44 was higher. Our finding of a higher attack rate for women corresponds to their data.

A high degree of seasonality is evident in the data, corresponding to the activity cycles of ants and man. Our data compare well with those of Yeager (1978) and show minimal activity in the 1st and 4th quarters of the year. In both studies, a fairly consistent attack rate was noted during the 2nd and 3rd quarters, except that activity in urban areas was highest in Sumter Co. during the 2nd quarter and in Lowndes Co. during the 3rd quarter.

Because we did not obtain complete participation in our medical survey to detect persons requesting medical treatment, we can draw no conclusions on this aspect of our study. None of the survey participants required medical treatment because of fire ant attacks. Clemmer & Serfling (1975) found that 4.5% of those persons receiving stings requested medical care. If the same percentage applied to our survey, we could have expected 4 persons to seek medical help. However, Clemmer & Serfling (1975) defined medical care as calling or visiting a physician, whereas we recorded only actual visits to a physician's office. Since our limited survey of physicians turned up 5 fire ant-related cases in the month of February, a month of limited fire ant activity, it would not be unreasonable to extrapolate that more than 100 persons may have obtained medical treatment for fire ant stings during 1976.

LITERATURE CITED

- Baer, H., T. Y. Liu, M. C. Anderson, M. Blum, W. H. Schmid & F. J. James. 1979. Protein components of fire ant venom (*Solenopsis invicta*). *Toxicon* 17: 397–405.
- Brand, J. M., M. S. Blum, H. M. Fales & J. G. MacConnell. 1972. Fire ant venom: comparative analysis of alkaloid components. *Toxicon* 10: 259–71.
- Clemmer, D. L. & R. E. Serfling. 1975. The imported fire ant: dimensions of the urban problem. *South. Med. J.* 68: 1133–38.
- Lawrence, R. S., J. E. Keil, L. L. Brown & H. B. Jackson. 1973. The imported fire ant: a newly recognized problem in South Carolina. *J. S.C. Med. Assoc.* 69: 319–21.
- Lockey, R. F. 1974. Systemic reactions to stinging ants. *J. Allergy Clin. Immunol.* 54: 132–46.
- MacConnell, J. G., M. S. Blum & H. M. Fales. 1970. Alkaloid from fire ant venom: identification and synthesis. *Science* 168: 840.
- Rhoades, R. B., D. Kolof, F. Bloom & H. J. Wittig. 1978. Cross reacting antigens between imported fire ants and other hymenopterous species. *Ann. Allergy* 4: 100–04.
- Rhoades, R. B., W. L. Shafer, M. Newman, R. Lockey, R. M. Dozier, P. F. Wubbena, A. W. Townes, W. H. Schmid, G. Neder, T. Brill & H. J. Wittig. 1977. Hypersensitivity to the imported fire ant in Florida: a report of 104 cases. *J. Fla. Med. Assoc.* 64: 247–54.
- Rhoades, R. B., W. L. Shafer, W. H. Schmid, P. F. Wubbena, R. M. Dozier, A. W. Townes & H. J. Wittig. 1975. Hypersensitivity to the imported fire ant: a report of 49 cases. *J. Allergy Clin. Immunol.* 56: 84–93.
- Yeager, W. 1978. Frequency of fire ant stinging in Lowndes County, Georgia. *J. Med. Assoc. Ga.* 2: 101–02.