

## INCIDENCE OF STINGS OR BITES OF THE RED IMPORTED FIRE ANT (HYMENOPTERA: FORMICIDAE) AND OTHER ARTHROPODS AMONG PATIENTS AT FT. STEWART, GEORGIA, USA

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**Abstract.** Medical treatment for arthropod sting/bite attacks was requested at Ft. Stewart, Georgia, USA, by 329 persons during the period 1 April to 30 September 1979. A total of 370 visits, including 7 days hospitalization for 5 patients, was recorded for these patients. The red imported fire ant (RIFA) was responsible for 49% of the outpatient visits and 5 days of hospitalization. Attacks by unidentified arthropods were responsible for 26% of the visits. The remainder of the cases (ranging from 1 to 5% each) were attributed to wasps, bees, spiders, mosquitoes, ticks, chiggers and fleas. The predominant age category of military personnel, 18-44 years, accounted for 78% of the patients. Eight persons (5%) stung by RIFA exhibited symptoms of shock, and 11 (7%) developed secondary infections, most requiring multiple visits for treatment. Nine symptoms were identified for 278 patients, with edema (82%), urticaria (43%) and respiratory distress (5%) predominating. Other symptoms, which included nausea, vomiting, dizziness, numbness and blurred vision, occurred predominantly in patients under 25 years of age. Cost of treatment, based on data supplied by the Office of the Surgeon General, U.S. Army, is discussed.

The stings or bites of arthropods may be extremely debilitating and can cause death in hypersensitive individuals. Ewing (1928) documented observations on the injuries caused by the bites or stings of spiders and scorpions, and Swinny (1950) published observations on 13 patients exhibiting severe local or systemic nonfatal reactions resulting from hymenopterous stings. Ressmann et al. (1955) described the mode of action of the venoms of certain noxious species of Arachnida, Chilopoda and Hexapoda in southwest Texas. Micks (1960), in a study of the arthropods of medical importance in Texas, stated that hymenopterous species constituted a much greater medical problem in Texas than all other arthropods combined. In 1961, the American Academy of Allergy established an Insect Allergy Committee for the purpose of creating a registry of persons allergic to arthropod bites or stings and for gathering annual information on their subsequent exposure to arthropods (Kailin 1962). By 1963, over 3000 registrants were listed. Of these, 2606 replies were evaluated and cate-

gorized by sex and age of respondent, and placed in 5 categories depending on severity of reaction, i.e., local reaction, slight, moderate, or severe general reaction, or delayed reaction. There was a slight predominance of male (57%) over female (43%) respondents. An age-related incidence of severe general reactions was found for males of the study population, with 57% of those over 60 years of age falling into this category as compared to 6% of the males 5 years old or younger. This trend was not present among females of this study population, although the highest percentage (31) in the severe general reaction category were females over 60.

Our interest in the subject relates to studies on the economic and public health impact of the red (RIFA) and black imported fire ants, *Solenopsis invicta* Buren and *S. richteri* Forel, and in particular to their importance relative to other stinging and biting arthropods. During their rapid spread in a period of 40 to 60 years over  $9.3 \times 10^7$  ha in 9 states, the imported fire ants have received increasing attention from the medical profession. Dr R. F. Triplett of the Mississippi Allergy Clinic, Jackson, MS, (unpubl. data) surveyed physicians selected from portions of Mississippi, Alabama and Georgia in 1971, requesting information on the number of patients treated for fire ant stings, symptomology, and any related complications for 1969, 1970 and 1971. Results of this 3-year study indicated an overall increase in RIFA sting attacks of 22 and 28% for 1970 and 1971, respectively. Similarly, there was a consequent rise in the percentage of allergic reactions among patients treated of 24 and 28% for those years. Most striking in Triplett's data was the increase of cases reporting anaphylaxis: 54 and 49% for 1970 and 1971, respectively. The rise in the number of shock reactions implies more frequent contact between humans and imported fire ants resulting in an increase in the number of persons sensitized to the venom. This high rate of exposure was illustrated in 3 recent surveys. Clemmer & Serfling (1975) conducted a telephone survey of 240 households

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TABLE 1. Age, sex and number of persons reporting to the dispensary at Ft. Stewart, Georgia, for treatment of arthropod stings or bites, 1979.

AGE GROUP	NO. PERSONS WITH STINGS OR BITES									TOTAL (%)
	RIFA	WASP	BEE	SPIDER	MOSQ.	TICK	CHIG.	FLEA	UNKNOWN	
$\delta$										
0-9	29	0	1	0	0	2	0	2	7	41 (17)
10-17	1	0	0	0	1	0	0	0	3	5 (2)
18-25	72	6	5	7	6	7	13	0	39	155 (62)
26-44	18	2	0	5	2	6	1	0	12	46 (19)
45+	0	0	0	1	0	0	0	0	0	1 (4)
Total (%)	120 (48)	8 (3)	6 (2)	13 (5)	9 (4)	15 (6)	14 (6)	2 (1)	61 (25)	248
$\text{♀}$										
0-9	11	1	0	0	3	1	0	0	6	22 (27)
10-17	3	0	1	0	0	0	0	0	0	4 (5)
18-25	15	1	2	0	1	1	0	0	11	31 (38)
26-44	12	2	2	1	0	0	0	0	6	23 (28)
45+	0	0	0	0	0	0	0	0	1	1 (1)
Total (%)	41 (51)	4 (5)	5 (6)	1 (1)	4 (5)	2 (2)	0 (0)	0 (0)	24 (30)	81
$\text{♂ and ♀}$										
0-9	40	1	1	0	3	3	3	2	13	63 (19)
10-17	4	0	1	0	1	0	0	0	3	9 (3)
18-25	87	7	7	7	7	8	13	0	50	186 (57)
26-44	3	4	2	6	2	6	1	0	18	69 (21)
45+	0	0	0	1	0	0	0	0	1	2 (1)
Total (%)	161 (49)	12 (4)	11 (3)	14 (4)	13 (4)	17 (5)	14 (4)	2 (1)	85 (26)	329

in Metairie, Louisiana, to determine the sting rates among a suburban population (June to August 1973). They stated that 29% of the study population reported stings, with 55% of these occurring among children under 10 years of age. Minimal allergic reactions were reported for 17% of the victims, and 4.4% of the population required medical consultation. Yaeger (1978) monitored the sting attack rate for 438 persons in Lowndes Co., Georgia, and found that the stinging rate was 23,920 per 100,000 persons. The probability of a person being stung was 1 in 5 per month. Less than 5% of the sting attacks were sufficiently severe to require professional medical care. Adams & Lofgren (1981) noted that ca. 35% of the population in Sumter Co., Georgia, was stung at least once during 1 year. They indicated that most sting attacks occurred in the spring and summer and that the highest sting rate (ca. 50%) occurred in persons under 20 years of age.

Triplett (1973) described the allergic reactions of 18 patients that had been stung by imported fire ants. Symptomology included generalized urticaria (84%), generalized angioedema (78%), respiratory distress (50%), gastrointestinal involvement (11%), and anaphylactic shock reactions (16%).

Rhoades et al. (1977) conducted an extensive clinical study of 104 cases of hypersensitivity to the imported fire ant in Florida. Hyposensitizing injections were given to 92 patients, of which 19 were subsequently restung; only 2 of these patients suffered a systemic reaction. Further, patient charts of an allergist from Jacksonville, Florida, were analyzed to compare numbers of patients exhibiting allergic responses to imported fire ant stings vs. other stinging hymenopterans during the period from 1 November 1973 to 31 October 1974. Eighteen cases of allergy to imported fire ants were reported, compared to 15 cases for all other hymenoptera. During the same period an allergist in the Tampa, Florida, area with an expressed interest in insect allergies observed 25 patients, 15 with reactions to imported fire ants, 1 to red ants and the remaining 9 to bees or wasps.

The purpose of the present study was to compare the sting/bite rates of arthropods among military and dependent personnel at Ft. Stewart, Georgia. The study was conducted from 1 April to 30 September 1979, when the personnel received maximum exposure during work or recreational activities. A review of the case histories also provided data on relative symptomology.

TABLE 2. Severity of sting/bites of arthropods requiring medical consultations, Ft. Stewart, Georgia, 1979.

ARTHROPOD	TOTAL PATIENTS	TOTAL VISITS	SEVERITY OF STING/BITES			NO. PATIENTS WITH	
			MILD	MODERATE	SEVERE	SHOCK REACTION	SECONDARY INFECTION
RIFA	161	177	70	61	30	8	11
Wasp	12	12	5	4	3	0	1
Bee	10	13	5	3	2	0	0
Spider	15	21	7	7	1	0	2
Mosquito	13	13	5	1	7	1	3
Tick	17	18	12	2	3	1	2
Chigger	14	18	8	6	0	0	2
Flea	2	2	0	2	0	0	2
Unknown	85	96	35	39	11	1	12
Total	329	370	147	125	57	11	33

#### MATERIALS AND METHODS

Ft. Stewart is a multifaceted U.S. Army training installation and serves as a National Guard training facility during the summer months. The reservation is located at Hinesville, Georgia, west of Highway I-95 and approximately 25 km southwest of Savannah, encompassing an area in excess of 100,000 ha, including parts of Liberty, Bryan and Evans Counties. The terrain varies from poorly drained hardwood swamps, through heavy clay soils supporting dense stands of slash pine, to well-drained, semi-xeric sands supporting sparse stands of native scrub oak. The area is bisected west to east by the Canooche River drainage area and north to south by State Highway 19. The post is further criss-crossed by unpaved service roads. Portions of the reservation have a history of treatment with mirex for control of the red imported fire ant dating from the fall of 1963. The most recent treatment in that portion of the state was a single application of mirex during the fall of 1971. Populations of the red imported fire ant have become well established since that time and the area is now considered to be moderately to heavily infested.

The post population at the time of our survey (1979) consisted of ca. 12,000 active-duty military personnel and 11,000 dependents. Most of these people reside and/or work in the eastern 10% of the reservation. Approximately 75% of the active-duty personnel are 18-44 years old.

Questionnaires requesting information on individuals seeking medical assistance were distributed to all dispensaries and to the hospital emergency room. Patients were asked to complete a portion of the form including their age and sex, location at the time of the episode and identification, if pos-

sible, of the arthropod responsible. Six arthropod categories were listed on the form, as follows: imported fire ant (the dominant species of ant in this area), wasp, bee, spider, other and unknown. Medical personnel were asked to complete the section relating to medical impact, i.e., severity of the sting/bite following symptomology and secondary infection. They also noted whether the patients were experiencing a shock reaction; however, the criteria for what constituted "shock reaction" was left to the discretion of the medical examiners. Forms were collected weekly and mailed to our laboratory in Gainesville, Florida, for compilation and analysis of data. Cost analysis data were supplied by the Office of the Surgeon General, United States Army.

#### RESULTS AND DISCUSSION

Arthropod sting/bite episodes were recorded for 329 persons, resulting in 370 outpatient and emergency room visits during the period from 1 April to 30 September 1979 (Table 1). A total of 161 (49%) of the patients were treated for red imported fire ant stings. The relative attack rates for wasps, bees, spiders, mosquitoes, ticks and chiggers were very similar (3 to 4%); 26% of the patients were unable to identify the arthropod responsible for the attack. The predominant military age categories of 18 to 25 and 26 to 44 accounted for 78% (255) of the patients. Individuals below age 18 (72) accounted for 22% of the patients, while only 2 persons 45 years or older reported attacks.

Minor differences were noted between the number of stings reported by male and female patients. While the red imported fire ant was the predominant cause of stings/bites for both sexes, a higher percentage of females suffered from attacks by

TABLE 3. Symptomology of arthropod sting/bites,\* Ft. Stewart, Georgia, 1979.

ARTHROPOD	No. PATIENTS	NO. PATIENTS WITH			
		EDEMA	URTICARIA	RESPIRATORY DISTRESS	OTHER**
RIFA	140	114	72	10	14
Wasp	10	10	1	1	2
Bee	6	6	2	0	1
Spider	15	11	3	0	3
Other***	35	27	15	0	4
Unknown	72	60	26	3	4
Total (%)	278	228 (82)	119 (43)	14 (5)	28 (10)

\* 51 patients (15.5%) indicated no symptoms.

\*\* Includes nausea, vomitus, dizziness, numbness, drowsiness and blurred vision.

\*\*\* Includes mosquito, tick, chigger and flea.

bees, but a lesser percentage from spiders, ticks and chiggers. Visits resulting from unidentifiable arthropod stings or bites were slightly higher for females. A higher percentage of patients in the 18 to 25 and 26 to 44 age categories were male (81 vs. 66%), while a higher percentage of patients in the 0 to 9 and 10 to 17 age groups were female.

The severity of the reactions to the sting/bite episodes, as identified by medical personnel (Table 2), indicated that 45% (147) of the individuals exhibited mild reactions, 38% (125) moderate reactions and 17% (57) severe reactions. Pustule formation, characteristic of the sting of the red imported fire ant, was reported for 88% (141) of the patients stung by this insect. Additionally, 55% (47) of those stung by unknown species also reported pustule formation. This suggests that a large number of these cases were the result of fire ant stings and, in fact, Rhoades (1977) considers pustule formation as presumptive evidence that the sting was from an imported fire ant. With the exception of those from ticks and fleas, about 40 to 60% of the reactions were considered moderate or severe. Eight persons (5%) stung by RIFA exhibited symptoms of shock compared to 1 each for mosquitoes,

ticks and unknown arthropods. Surprisingly, none of the patients stung by bees or wasps expressed shock symptoms. This may be related to the relatively small sample population attacked by these insects. Eleven (7%) of the persons attacked by RIFA developed secondary infections. This was a lower percentage than for wasps, spiders, mosquitoes, ticks, chiggers and unknown arthropods. Most of the patients suffering from secondary infections required multiple visits for treatment.

Nine symptoms were identified for 278 of the patients requesting treatment, with no symptomology reported for 51 patients (Table 3). The most frequently listed symptoms were edema, 228 (82%); urticaria, 119 (43%); and respiratory distress, 14 (5%).

These data show that edema and urticaria were common symptoms for all arthropod stings/bites and frequently occurred in combination with respiratory distress. Other symptoms, which imply a more severe reaction, included nausea, vomiting, dizziness, numbness and blurred vision. There were a few patients with these symptoms and they were predominantly under 25 years of age. A lower percentage of persons stung by fire ants exhib-

TABLE 4. Numbers and percentages of patients at various locations at time of arthropod sting/bite, Ft. Stewart, Georgia 1979.

ARTHROPOD	HOME	SCHOOL	PLAYGROUND/ RECREATION	PASTURE/ CROPLAND	WORK/OTHER
RIFA	76	1	3	10	71
Wasp	3	0	2	0	7
Bee	5	0	1	0	4
Spider	7	1	0	0	7
Other*	7	1	3	0	35
Unknown	36	2	5	2	40
Total (%)	134 (40.7)	5 (1.5)	21 (6.4)	5 (1.5)	164 (49.8)

\* Includes mosquito, tick, chigger and flea.

ited these symptoms (10%) than for persons stung or bitten by other arthropods (15 to 27%). However, since many more persons were stung by fire ants, this species presented the greater health risk.

The locations of the patients at the time of the sting/bite attack (Table 4) were about equally divided between home and work environments with the exception of the "other" category, which included ticks and chiggers. Most of these encounters were in the work environment. This is not surprising, since ticks and chiggers occur most commonly in wooded and undeveloped areas, sites in which soldiers conduct many of their training activities.

Six patients (1.8%) required hospitalization for a total of 7 days, 5 from fire ant stings for 1 day each, and 1 from a tick bite for 2 days. Additionally, 1 patient was assigned to quarters for 2 days as the result of a tick bite, and 1 was referred to minor surgery for excision of an embedded tick.

Medical costs directly attributable to arthropod bite/sting attacks were based on medical cost data furnished by the Office of the Surgeon General, U.S. Army. A single outpatient visit costs \$23.10, while the cost of hospitalization was \$176.45/day. Thus, the direct medical cost for all arthropod attacks for the period of this study was \$9,782; outpatient visits accounted for \$8,547 and hospitalization for \$1,235. Red imported fire ants were responsible for 49% of the outpatient visits (\$4,188) and 71% of the hospitalization (\$882), for a total of \$5,070.

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