The Real Enemy

Scrub Typhus and the Invasion of Sansapor

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The covering force of the American Navy slipped past the main body of the invasion force at 0200 hours. The main body moved into final positions at 0500. It was now ready. Unlike many other invasions in the Pacific Theater during the Second World War, the landing near Cape Sansapor on Dutch New Guinea was not preceded by aerial or naval bombardment. The invasion planners for TYPHOON Task Force were counting on tactical surprise for the relatively few Japanese troops who were expected to be near the landing area.

Just before first light, the G.I.'s in the first landing craft could just barely make out the trees and coastline in the equatorial morning haze. The first wave of soldiers was ashore at 0700, experiencing no enemy opposition. Subsequent waves of G.I.'s waded with some difficulty through the knee-deep water and onto the beach. At the conclusion of the landing on July 30, 1944, there were more than 7,300 men of the 6th Infantry Division on the beachhead stretching from Cape Sansapor to Mar, a swampy area about seven miles northeast of Sansapor (Fig. 1).

The invasion of Sansapor was the last assault landing on New Guinea by General Douglas MacArthur's forces. The often bloody, desperate jungle fighting on New Guinea in 1943 and 1944 has largely been overshadowed in modern memory by the battles on Iwo Jima, Okinawa, and Saipan. But New Guinea was key to sweeping the Japanese from the Southwest Pacific, liberating the Philippines, and approaching Japan from the south. Throughout 1944, MacArthur's forces conducted a series of brazen seaborne envelopments in New Guinea, often completely bypassing and outflanking strong Japanese forces. The landing at Sansapor was intended to leapfrog between two strong Japanese forces on the Vogelkop Peninsula. After the landings, American combat engineers were charged with constructing airfields that were to provide support for MacArthur's inexorable push—and promise of return—to the Philippines. Consequently, although mostly forgotten, the operations in and near Sansapor were of considerable strategic importance (Smith 1953).

Fig. 1. Elements of the 1st Infantry Regiment, 6th Infantry Division, landing at Cape Sansapor, Dutch New Guinea (U.S. Army).

On July 31, the American combat forces moved inland from the landing zones toward the Sansapor plantation and village. Here, too, there was no resistance; Japanese troops of the 35th Division had departed the area several days before, leaving many supplies. Engineers immediately began building airfields in the best locations, and combat operations over the following three weeks were limited to flushing out small groups of Japanese soldiers.

American casualties were very low through August 5. Then, the real enemy—scrub typhus—emerged from the jungle. The entire American operation was in peril.

The outbreak began after troops bivouacked on the ground in partially cleared areas near Mar Village. After the first soldier reported to the hospital on August 6, the epidemic rapidly developed. By August 11, there were 135 cases; by September 30, 931 men had been hospitalized. Among the earliest cases were the 1st Infantry Regiment Commander, Colonel Privett, and several other key officers. Forward hospitals filled quickly with febrile and delirious men. Just two weeks into the epidemic, the hospital case rate was more than 900 per thousand per year—the highest case rate among all causes in the American Army in any theater for an individual episode (Philip 1948, 1964) (Fig. 2).

Chigger-borne rickettsiosis, Japanese river fever, mite-borne typhus, scrub typhus, tropical typhus, and tsutsugamushi disease are all names for the same disease. The most colorful name is tsutsugamushi disease, which means "small and dangerous creature" in Japanese. Scrub typhus derives its name from the scrub vegetation so often found near areas where the disease occurs. The disease is present in a broad area from Pakistan to Southeastern Russia to Japan, the Philippines, and northern Australia. Within this diverse area, persistent disease areas known as "mite islands" or "typhus islands" can be highly focal (USACHPPM 2006).

First described from Japan in 1899, scrub typhus is caused by the rickettsial bacterium *Orientia tsutsugamushi* (= *Rickettsia tsutsugamushi*). The bacterium is vectored primarily by a larval *Leptotrombidium* (= *Trombicula*) mite, the "small and dangerous creature" of the Japanese. In most human cases, the pathogen is transmitted

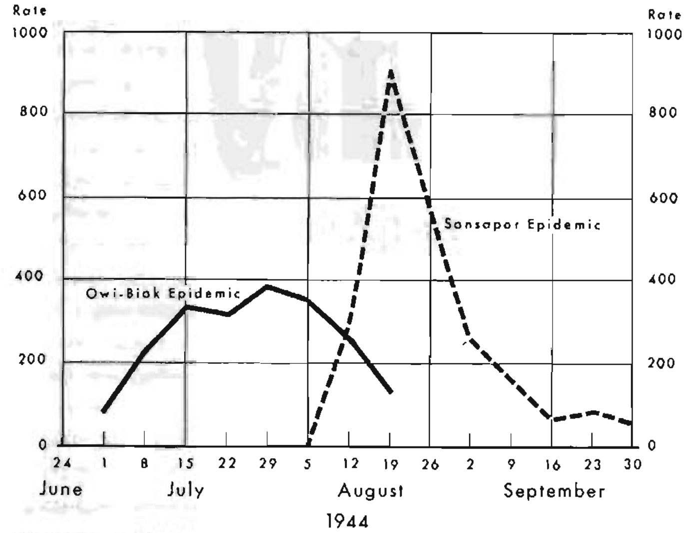

Fig. 2. Scrub typhus case rates (cases per thousand per year) by date for Owi-Biak and Sansapor epidemics (from Philip 1964).

by *L. akamushi* or *L. deliense* (Fig. 3). Infection by *O. tsutsugamushi* lasts throughout the mite's life, and is transovarially transmitted. Therefore, the mite is the primary reservoir for the pathogen. Adult mites lay eggs singly in humid areas covered with low vegetation. The six-legged *Leptotrombidium* larva is the only stage that feeds on a host. The mite is first infected by feeding on murid rodents near the site of egg hatch. After feeding for two to three days, the engorged larva drops from the host, becoming an eight-legged, velvet-textured nymph in about 10 days. The nymphs become adults in another 30 days (Fig. 4). Both nymphs and adults feed on insect eggs and minute arthropods (Harwood and James 1979).

Humans are infected when they come into contact with the larval mites. The mites feed primarily on host lymph fluid and their salivary glands have the highest concentrations of *O. tsutsugamushi*. After a 10-12 day incubation period, the onset of symptoms can be sudden and serious. For about a week, clinical symptoms may include high fever, headache, conjunctivitis, swollen lymph nodes (lymphadenitis), and slowing of the heartbeat rate (bradycardia). At the same time, an 8-12 mm lesion, known as an eschar, can be seen at the site of

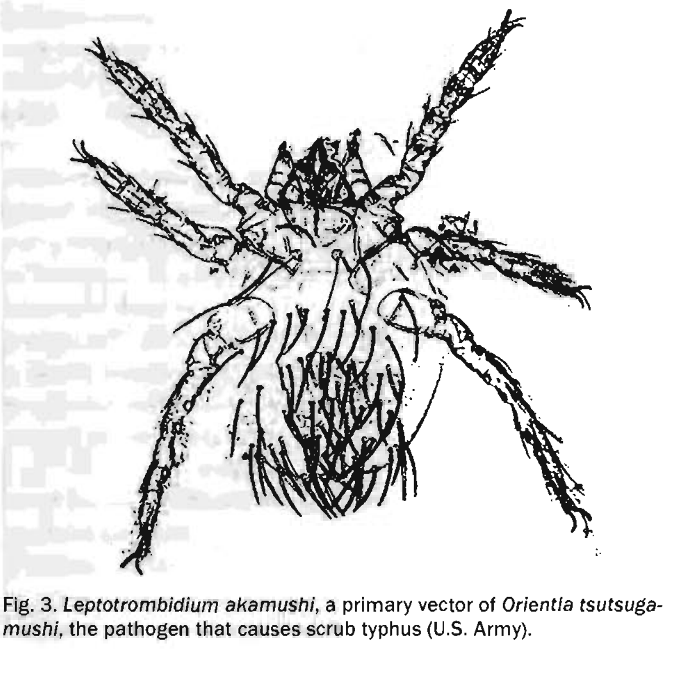

Fig. 3. *Leptotrombidium akamushi*, a primary vector of *Orientia tsutsugamushi*, the pathogen that causes scrub typhus (U.S. Army).

the bite (Fig. 5). Over the next few days, the eschar ruptures and is covered with a black scab. Also, a red spotted rash develops over the body. By the second week after initial symptom development, symptoms may include enlargement of the spleen, pneumonia, inflammation of the heart (myocarditis), delirium, and ultimately death. However, the majority of patients recover within five weeks (Harwood and James 1979).

Despite not having to fight Japanese troops at the same time, the epidemic was costly. The mortality rate was 3.4 percent. More than 150,000 man-days were lost to the disease at Sansapor and on the nearby islands of Owi and Biak. Several units, including the 1st Infantry Regiment, were rendered ineffective by the disease (Philip 1948). Forward hospitals were strained beyond their limits and, because of their frail condition, febrile patients could not be transported to larger, rear-area medical facilities. Mortality rates during the outbreak varied from less than one percent on Owi and Biak to an incredible 33.5 percent at Finschhafen. Post-mortem analysis indicated that most men died from rickettsial vasculitis, which led to peripheral circulatory collapse. Not surprisingly, this was the same cause of death as that caused by louse-borne typhus, *Rickettsia prowazekii* (Zarafonetis et al. 1963).

On the islands of Owi and Biak, scrub typhus cases developed in early June and peaked by the end of July (Fig. 1). The majority of cases were on Owi, but the cases on Biak developed as G.I.'s were trying to capture Japanese airfields and root out determined defenders. There, scientists had no choice but to conduct mite surveys, even as fighting raged on around them. On nearby Bat Island, an observation outpost manned jointly by Australians and Americans had to be abandoned because 26 of 41 troops were sickened by the disease. Subsequent research revealed that the island contained "an intense endemicity" with an abundance of rats, *L. deliense* as the vector, and at least three highly virulent strains of *O. tsutsugamushi* (Philip 1948).

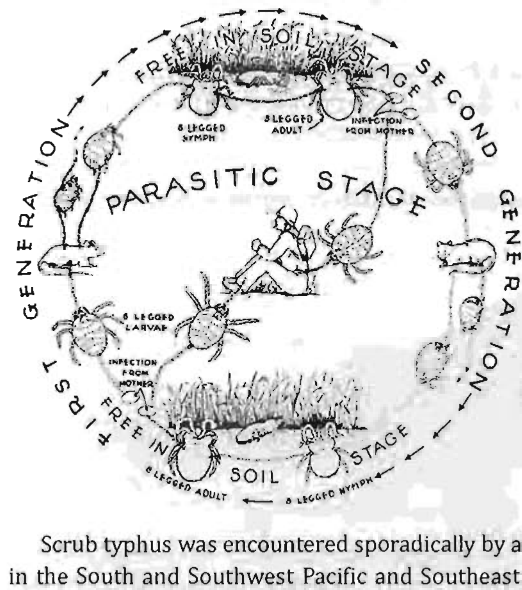

Fig. 4. Drawing of scrub typhus cycle in nature (from Philip 1964).

Scrub typhus was encountered sporadically by all of the armies in the South and Southwest Pacific and Southeast Asia Theaters. Members of the U.S.A. Typhus Commission, including entomologists, parasitologists, and epidemiologists, were involved in research on scrub typhus in the Southwest Pacific since October 1943, but the seriousness of the epidemic in August and September--and fear of future epidemics in the Philippines and Japan--brought swift action. Several members of the commission engaged directly in mite control

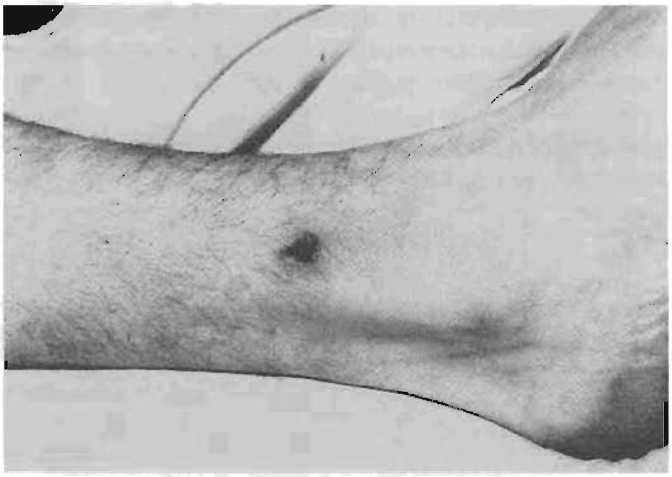

Fig. 5. Eschar of scrub typhus patient at the site of the mite's bite (U.S. Armed Forces Institute of Pathology).

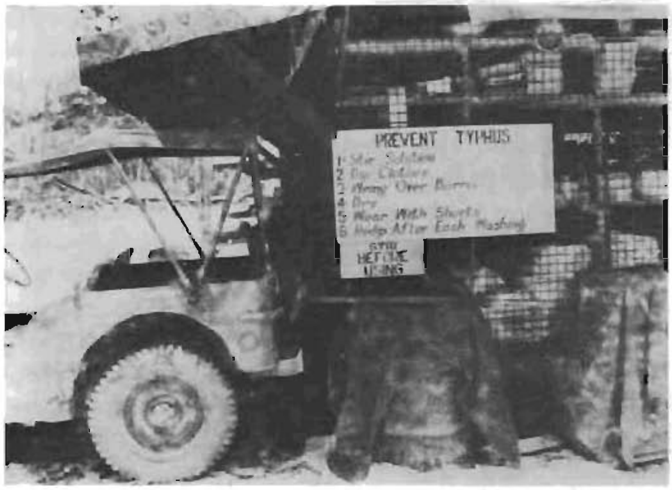

Fig. 7. Barrels of repellent emulsion used to treat uniforms (U.S. Army).

work with the troops and novel control methods were pressed into action (Philip 1964).

Because there were no preventive vaccines or curative antibiotics, the most effective management methods for scrub typhus involved mite control and personal protective measures. Unfortunately, DDT had little effect as a broadcast spray, spot treatment, or impregnation onto uniforms. In non-forward areas, such as camps and bases, clearing sites of vegetation and allowing the areas to dry was the most effective control tactic. The mites and their rodent hosts thrived in vegetation-covered, high-humidity areas near the ground, so they avoided the dried areas. By order of General MacArthur, at all times, men were to wear "a complete uniform consisting of shirt or jacket, trousers, leggins and cap, and that mosquito repellent shall be used about leggin tops, sleeve cuffs and shirt or jacket collars." (Smith 1953). As might be imagined, in the sweltering tropical heat, the troops were less than pleased with this order (Fig. 6).

In forward areas, the best way to manage mites was by impregnating uniforms with a repellent and miticide consisting of a dimethyl phthalate-soap emulsion (Fig. 7). This treatment was based on successful trials during the war with North American chiggers by entomologists at the USDA Laboratory in Orlando, Florida. The Australian military was the first to successfully use the technique in the field (Philip 1964). Although employed too late for effective use in the Sansapor epidemic, hand-treated uniforms were put to good use in subsequent campaigns in the Philippines.

With the rigid implementation of management tactics, new cases dropped rapidly by the end of August, and most of September saw case rates less than 100 per thousand per year. The construction of airdromes and runways proceeded with little difficulty, and by mid-September, numerous sorties were being flown daily to support other landings, intercept Japanese planes, and bomb oil installations, troop concentrations, and airfields throughout the area. The invasion of Sansapor also prevented the escape of Japanese forces from the Vogelkop Peninsula. The isolated forces were destined to wait out the end of the war in the fortified city of Sorong.

The 6th Infantry Division remained on the Vogelkop Peninsula until the end of December 1944. In January, the division was heavily involved in the invasion of the Philippines and spent the remainder of the war there before occupying the southern half of Korea.

Although overshadowed by dengue (90,000 U.S. military cases) and malaria (470,000 U.S. military cases), scrub typhus exacted a significant toll during the Second World War. There were more than 7,000 cases in the American Army and Navy from 1942 through 1945, with more than 300 deaths. American, British, and Australian cases exceeded 16,000, with more than 600 deaths. In the Pacific Theater it was second in importance only to malaria, yet it was more dreaded by the troops (Philip 1948). It caused almost as many deaths as malaria and was the most important rickettsial disease among American troops. In the Southeast Asia Theater, scrub typhus was the leading cause of death for any communicable disease.

Some American troops during the epidemic were convinced that scrub typhus was a biological weapon of the Japanese. Rumors were rampant, but there is no evidence to support the claim (Philip 1948). Indeed, *O. tsutsugamushi* vectored through *Leptotrombidium* mites

Fig. 6. Education poster used in the Pacific Theater (U.S. Army).

would make a very poor choice as a weapon. Japanese troops also suffered from the disease throughout the Pacific, but records remain sparse. It seems highly probable that the Japanese experienced the disease on Biak and at Sansapor, but as Philip (1964) stated, "...captured prisoners with medical background were not plentiful for questioning in this regard."

Today, scrub typhus can be cured relatively easily using antibiotics. There is still no vaccine and personal protective measures such as repellents and insecticide-impregnated uniforms continue to be very important in the management of the disease.

The role of Allied scientists, including many entomologists, during the Second World War cannot be overstated. Not only were arthropod-borne diseases managed relatively effectively during that time, but knowledge about the diseases also advanced dramatically. And, sadly, several researchers gave their lives in service to their countries. Philip (1948) gives a fitting tribute to the scientists who succumbed to scrub typhus during the war.

The events surrounding the epidemic of scrub typhus during the invasion of Sansapor have been repeated countless times in the history of warfare. Since the beginning of recorded history, invading armies have often been devastated not by defending forces, but by opportunistic pathogens waiting to spread disease to immunologically naïve soldiers (Peterson 1995). It was not until the 20th century that the losses from battle injuries exceeded those from diseases. Despite modern medical technology, the threat from arthropod-borne diseases remains for military forces. There are still numerous diseases for which there are no vaccines or effective curative drugs, as the current military cases of cutaneous leishmaniasis in Iraq and Afghanistan clearly demonstrate. Given this reality, control of arthropod vectors and protection of troops from bites remain important disease management strategies.

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