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# LIFE HISTORY OF THE GRAIN ITCH MITE, *PYEMOTES TRITICI* (ACARINA : PYEMOTIDAE)

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**Summary**

*One of the most common hosts of the grain itch mite,* ***Pyemotes tritici****, is the koa haole seed weevil,* ***Araecerus levipennis****, which infest the seeds of the koa haole,* ***Leucaena glauca****. On this host, mated* ***P. tritici*** *females start to reproduce after 4 to 5 days of feeding and during their life span of 19.9 ± 1.6 (S.D.) days produce an average of 207 ± 9.7 offspring per female. The percentage of parasitism and sex ratio of this mite in the field are also reported.*

## Introduction

*Pyemotes tritici* was first described by Krczal in 1959 from specimens collected by W.W. Boyle from the dry-wood termite, *Cryptotermes brevis* (Walker), and the koa haole seed weevil, *Araecerus levipennis* Jordan, in Honolulu, Hawaii. This mite is known to parasitize various kinds of insects. Some of the common hosts are the colleopterous larvae which infest the seeds of such plants as koa haole (*Leucaena glauca* (L.) Benth.), kiawe (*Prosopis pallida* (Humb, and Bonpl. ex Wild) HBK), monkeypod (*Samanea saman* (Jacq.) Merr.), and the various species of *Cassia*[1]. Man is sometimes attacked by *P. tritici* and other species of *Pyemotes*; however, they are not known to reproduce on him. Man is bitten by these pyemotid mites when he comes in close contact with products infested by insects which are parasitized by them.

The symptoms of dermatitis caused by *P. tritici* are similar to those caused by other species of *Pyemotes*. A pruritic skin lesion which is rosy red and about 0.5 cm in diameter develops on the site of each bite. Because of the intense itching, the lesion is often excoriated by scratching, thus allowing secondary infection to set in[2-6]. "Kiawe itch", "grain itch", "hay itch", "barley itch", and "water itch" are some of the terms used to designate the dermatitis caused by the different species of *Pyemotes*[7-9]. As a relief measure for the intense itching, kerosene[10], bathing in warm water containing soda[11], and calamine lotion containing 1% precipitate of sulfur and 2% phenol[1] have been recommended.

There are many cases of pyemotid-caused dermatitis in humans recorded in the literature from various countries. Studies of these cases have revealed that the victims handled products such as cereals and beans infested by insects parasitized by species of *Pyemotes* just prior to being afflicted with an itch[12, 13]. Such case of dermatitis still appear from time to time in Bangkok, as *P. tritici* is commonly present in beetle-infested pods of such plants as *L. glauca* and *P. pallida* which are frequently collected. Very little is known of the biology of *P. tritici*. Therefore, this study was undertaken to obtain more information about its life history.

## Materials and Methods

Laboratory cultures of *P. tritici* were started from specimens collected from the larvae of *A. levipennis* in *L. glauca* pods in Bangkok. The mites were mass-reared on *C. brevis* and as required, individuals of a known age group were selected randomly from the laboratory cultures to conduct the various experiments reported in this paper.

The life history study of *P. tritici* was studied in an air-conditioned laboratory in which the temperature and humidity ranged between 24.2–27.2°C and 50–54% respectively. Newly-emerged females were used in determining the life cycle, reproductive capacity, longevity, and the other aspects of biology. They were reared on freshly-killed *C. brevis* nymphs and on *A. levipennis* larvae. These *P. tritici* females together with their hosts were held individually in 1.5 cm bottle caps or in lots in Syracuse Watch Glasses. The lips of the bottle caps and watch glasses were sealed with "Stikem" to prevent the mites from escaping and intruders from coming in. The mites caged in these containers were then placed in Scheibler Desiccators which served as constant humidity chambers. The humidity in the chambers was maintained at about 52% with a saturated solution of magnesium nitrate. This level of relative humidity was selected because it best simulates the humidity conditions under which *P. tritici* thrives in the field, and yields optimum survival and reproduction in the laboratory. At humidity levels above 60% the food source, the insect host, becomes moldy, and at levels below 45% it desiccates too rapidly to allow completion of the life cycle of *P. tritici*. The mites were taken out from the humidity chambers only briefly at 6 h intervals for examination under a dissecting microscope to obtain the necessary life history data.

## Description of Observation

*P. tritici* was found to reproduce ovoviviparously. The eggs hatched within the ovaries and the immature stages remained there until they reached sexual maturity. These eggs and immature stages occupied the bulk of the inside of the enormously enlarged opisthosoma of the gravid female (Fig. 1). When ready for birth, the offspring emerged in succession, anterior end first, through the mother's genital opening. In the case of mated females, the first 2 to 4 offspring were males and subsequent ones

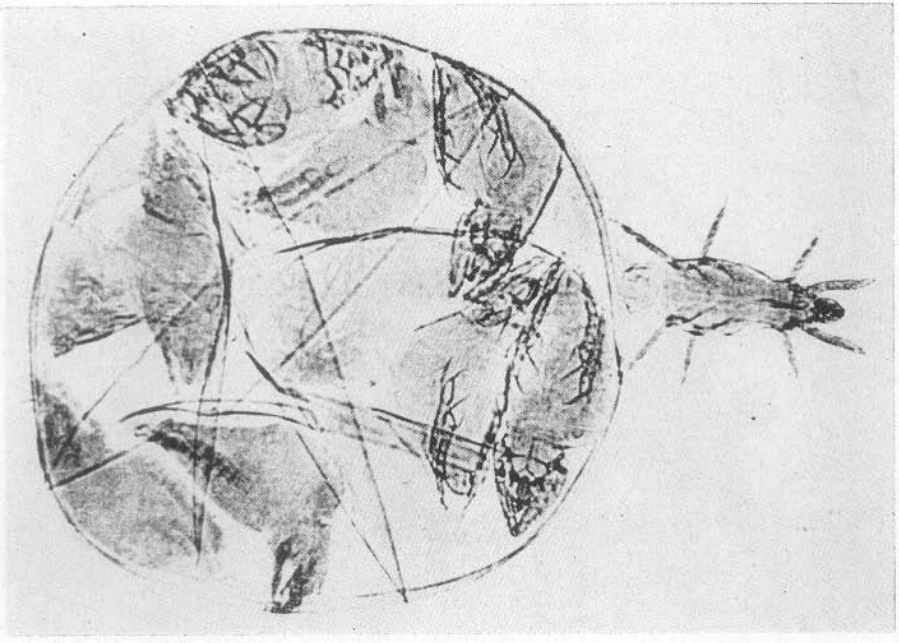

**Fig. 1.** A gravid female of *Pyemotes tritici* (× 1,000)

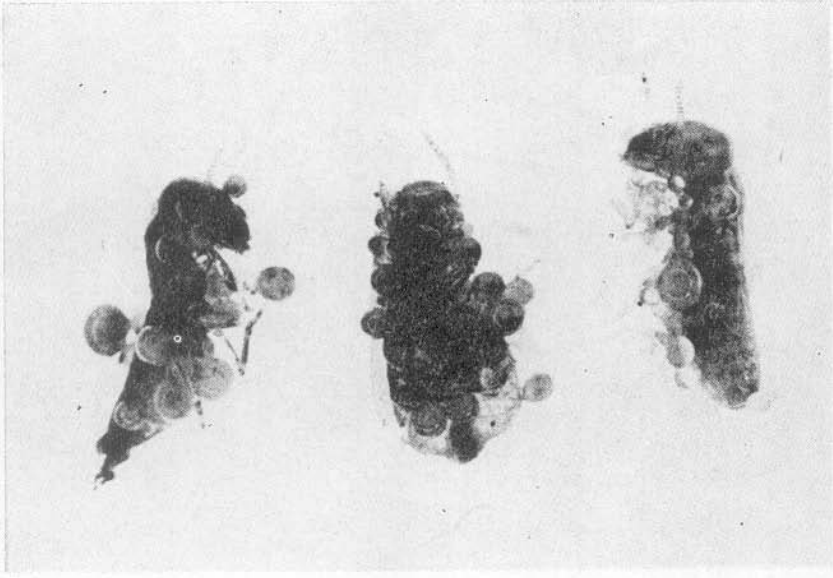

**Fig. 2.** *Cryptotermes brevis* being parasitized by *P. tritici* (× 1,000)

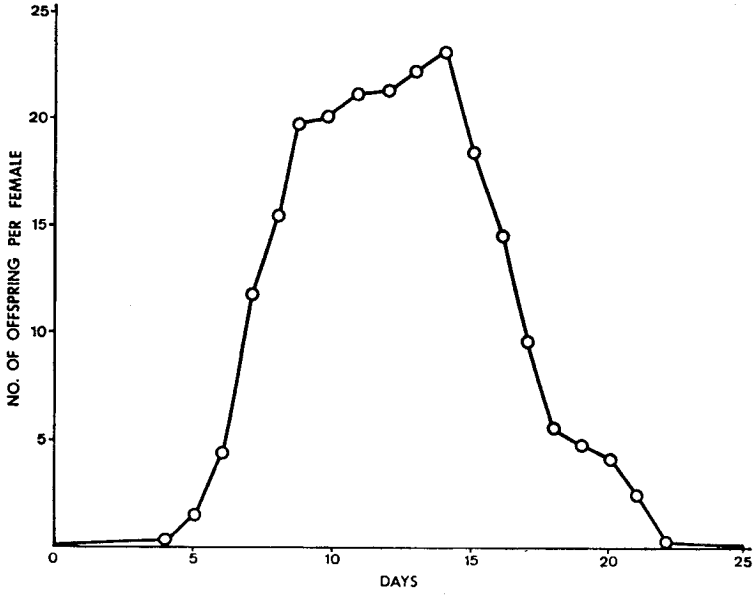


**Fig. 3.** Reproductive cycle of *P. tritici* (× 1,000)

all females, whereas in the case of unmated females, all of the offspring were males. Upon emergence, the males congregated around the mother's genital opening and waited for the birth of the female offspring. They obtained their nourishment from their mothers and seldom wandered far. As soon as the females were ready to emerge, the males vigorously vibrated their front pairs of legs up and down. As the females emerged, the males grasped them with their well developed hind legs and copulated. The females were released after a brief mating period of 10 to 30 seconds. One of the males mated with as many as 8 females during a period of 3 minutes and most of them mated with as many as 100 females during their normal life span of about 25 days. Also, some males mated with females that had been mated previously by them or by other males. Despite the habit of *P. tritici* males standing watch around the mother's genital opening, some females escaped mating. These females gave rise to all male offspring. Under field condition, however, only a few females can escape mating; for out of several hundred gravid females collected from various localities in Bangkok, only one of them produced all male offspring.

Most of the female offspring left their mothers soon after emergence to seek new hosts. As soon as a host was encountered, they paralyzed it. For most hosts, one *P. tritici* female was adequate to cause paralysis, but a ratio greatly in favor of *P. tritici* was needed to paralyze the nymphs of *C. brevis* (Fig. 2). When *C. brevis* was outnumbered by *P. tritici* as much as 5 to 1, 98% of the test termites were paralyzed, but none of them was paralyzed when the ratio was 1:1. In addition to the increase in the percentage of hosts paralyzed, the rapidity of paralysis also increased progressively with increase in the ratio of *P. tritici* to *C. brevis*. The time required for paralysis decreased from an average of $99.6 \pm 8.1$ (S.D.) minutes to $17.7 \pm 3.1$ minutes when the ratio of *P. tritici* females to *C. brevis* nymphs was increased from 5:1 to 25:1. The nymphs of *C. brevis* died 2 to 4 hours after being bitten by *P. tritici*; however, some of the larger hosts such as the larvae of *Galleria melonella* L. lived for several days after being immobilized, and when *P. tritici* was detached from their bodies soon after paralysis, they became active again. Those newly-emerged females that failed to find a host either returned to the original site of birth and started to compete with their mothers for the same food or died from starvation unless nourishment was obtained within 24 hours.

As soon as a source of food was found, the newly emerged females inserted their needle-like chelicerae through the membranous parts of the host's body and started to feed on its body fluids. As soon as feeding began, the posterior half of the opisthosomae of the famales started to swell. After 2 days of continuous feeding, the opisthosoma was so swollen that the mites were unable to crawl, and after 4 to 5 days it was fully swollen. The size of the fully-swollen opisthosomae of the females which fed on *C. brevis* was much larger than those of females feeding on *A. levipennis*. Despite their greater size, the females on the former host produced only half as many offspring as those on the latter host. However, on hosts of the same species, *P. tritici* females with greater opisthosomal enlargement tended to produce more offspring.

After 4 to 5 days of continuous feeding, the gravid females started reproducing. On the first day, only 1 or 2 offspring were produced. The rate of production increased during the first half of the reproductive period and then declined during the second half (Fig. 3). Death of the parent females usually followed soon after emergence of the last offspring, but in a few cases, some offspring continued to emerge for 3 to 4 days after death of their mothers. These offspring emerged not through the genital opening but by piercing through the thin, translucent opisthosomal wall of the dead female.

The longevity and the reproductive capacity of the gravid *P. tritici* females were influenced by such factors as host differences, amount of food consumed, and on whether or not they mated. When reared singly on *A. levipennis* larvae, mated females lived for $19.9 \pm 1.6$ days after emergence and produced an average of $207.7 \pm 9.7$ offspring per female, but on *C. brevis* nymphs, mated females lived for $23.4 \pm 2.7$ days and produced $106 \pm 6.6$ offspring while unmated ones lived for $17.7 \pm 2.1$ days and produced $49.3 \pm 6.7$ offspring. When more than one female, whether mated or unmated, were allowed to develop on an individual host, both longevity and reproductive capacity progressively docreased with increasing competition for food *P. tritici* females lived for $8.2 \pm 1.1$ days and produced $4.1 \pm 2.9$ offspring per female when 40 individuals where allowed to compete for the same *C. brevis* nymph. Under such an overcrowded conditions, the nymph was completely covered with the partially swollen *P. tritici*. Since food was not available to support all of them only a few reproduced. Some of them parasitized their own kind but never obtained sufficient nourishment for reproduction. The majority of them died *in situ*, for their opisthosomae were swollen beyond the point of being able to crawl to another host.

Both sexes were always present among the offspring of the mated *P. tritici* females, but the sex ratio was greatly in favor of the females. The sex ratio of the 11,943 specimens of *P. tritici* collected from the field between June, 1974 and February, 1975 was 1:62.6 in favor of females. A similar sex ratio, 1:61.6, was obtained in the laboratory when mated females were reared on *A. levipennis* larvae, but on *C. brevis* nymphs, the number of females decreased while the number of males remained the same for a sex ratio of 1:40.3. Furthermore, when the reproductive capacity of the females was reduced due to increased competition for food, the number of female offspring decreased while the number of the males remained the same, 3 to 5 per mother, as when reared singly on *A. levipennis* larvae or on *C. brevis* nymphs. Unmated females not only produced fewer offspring than mated ones but they produced only male offspring whether reared singly of in mass on *A. levipennis* or on *C. brevis*.

Although *A. levipennis* is a favorite host of *P. tritici*, this mite is not an important control agent of this anthribid beetle. The infestation of *L. glauca* by this weevil is usually high and the parasitization of it by *P. tritici* less than 10%.

*P. tritici* is able to parasitize *C. brevis* only when the individuals of the former greatly outnumber the latter. Inasmuch as *P. tritici* females do not migrate in mass, a situation where they outnumber the termites in a healthy colony is never created.

The few females that may gain access to a colony are undoubtedly accosted and killed by the soldiers and nymphs, for termites are known to clean each other of all foreign matter.

## บทคัดย่อ

จากการศึกษาชีวประวัติของไร ที่ทำให้เกิดอาการคัน ซึ่งเป็นตัวเบียนของตัวอ่อนด้วง *Araecerus levipennis* ซึ่งตัวอ่อนของด้วงชนิดนี้ทำลายเมล็ดของกระถินณรงค์ *Leucaena glauca* พบว่าไรตัวเมียที่ได้รับการผสมจะเริ่มออกลูกภายหลังการกินอาหารได้ 4-5 วัน และตลอดชีวิตเวลา 19.9 ± 1.6 (S.D.) วันของตัวเมียหนึ่งตัว สามารถให้ลูกได้ทั้งหมด 207 ± 9.7 ตัว และได้มีการสังเกตอัตราส่วนของเพศ และจำนวนเปอร์เซนต์ที่ไรไปทำลายตัวอ่อนของด้วงในภาคสนามด้วย

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