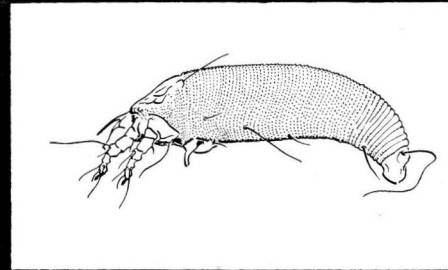
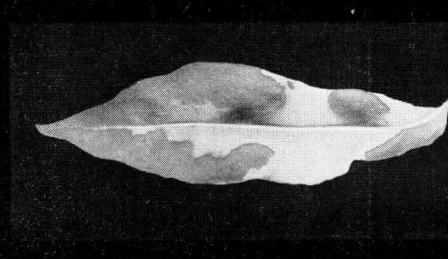
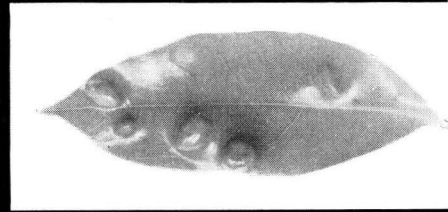
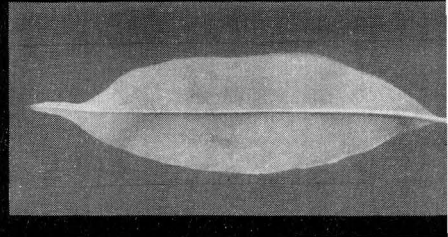
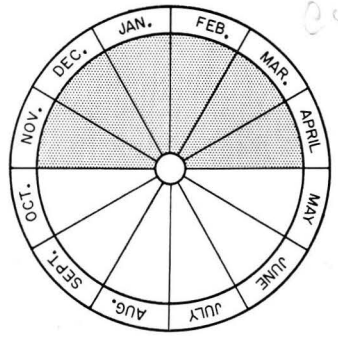


THE ERINOSE MITE OF

# *Lychee*

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### ACKNOWLEDGMENTS

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## THE ERINOSE MITE OF LYCHEE

The lychee, *Litchi chinensis* Sonn., is one of the most popular fruit trees in Hawaii; it is grown in backyards and to a certain extent in commercial orchards. One of the most serious foliage pests of lychee is the erinose mite, *Aceria litchii* (Keifer). It causes an abnormal condition known as "erinose" which is characterized by thick growths of felt-like galls on the leaflets.

The erinose mite is apparently a pest wherever the lychee is grown, for symptoms of erinose have been reported from various parts of the world. From southern China, Reinking (1919) reported the occurrence of "leaf galls with thickened wrinkled appearance, abnormal hair and velvet appearance." Groff (1921) reported that "lychee leaf galls" are widely spread in the vicinity of Canton, China. Hayes (1945) reported that in India erinose is the most important disease of lychee. In Hawaii, Higgins first reported the occurrence of the disease in 1916, and Carter in 1938 stated in his discussion of galls that erinose was a serious disease of lychee in Hawaii.

Various methods have been used in attempts to control this pest of lychee. The banding of the tree base with materials such as coal tar or crude oil to prevent the erinose mite from crawling up the tree was reported by Misra (1912) and by Hayes (1945). They also recommended stripping and burning the affected leaves and spraying the tree with crude oil emulsion and sulfur flowers. Higgins (1916) reported that effective control was obtained by spraying the trees with a solution containing nicotine sulfate and fish-oil soap. In general these methods in Hawaii have given either inconsistent results or have not given adequate control.

### SYMPTOMS OF ERINOSE

The lychee is not deciduous. Without shedding its mature leaves, it sends out periodically a flush of new leaves which are faint pink to light green. Examinations of the mature and young leaflets showed that erinose developed only on the latter.

When the erinose mite attacks a young leaflet, a thick growth of felt-like hair called "erineum" is produced on the lower surface. In severe attacks the entire lower surface of the leaflet is thickly covered with felt and the lateral margins roll upward. The leaflet thus assumes a cylindrical shape (fig. 1a). In less severe attacks the felting occurs in isolated patches of various sizes on the lower leaf surface (fig. 1b). On such a leaf, there is a bulging of the affected areas toward the upper surface of the leaflet (fig. 1c). Portions of a tree with felted and deformed leaflets are shown in figures 2 and 3.

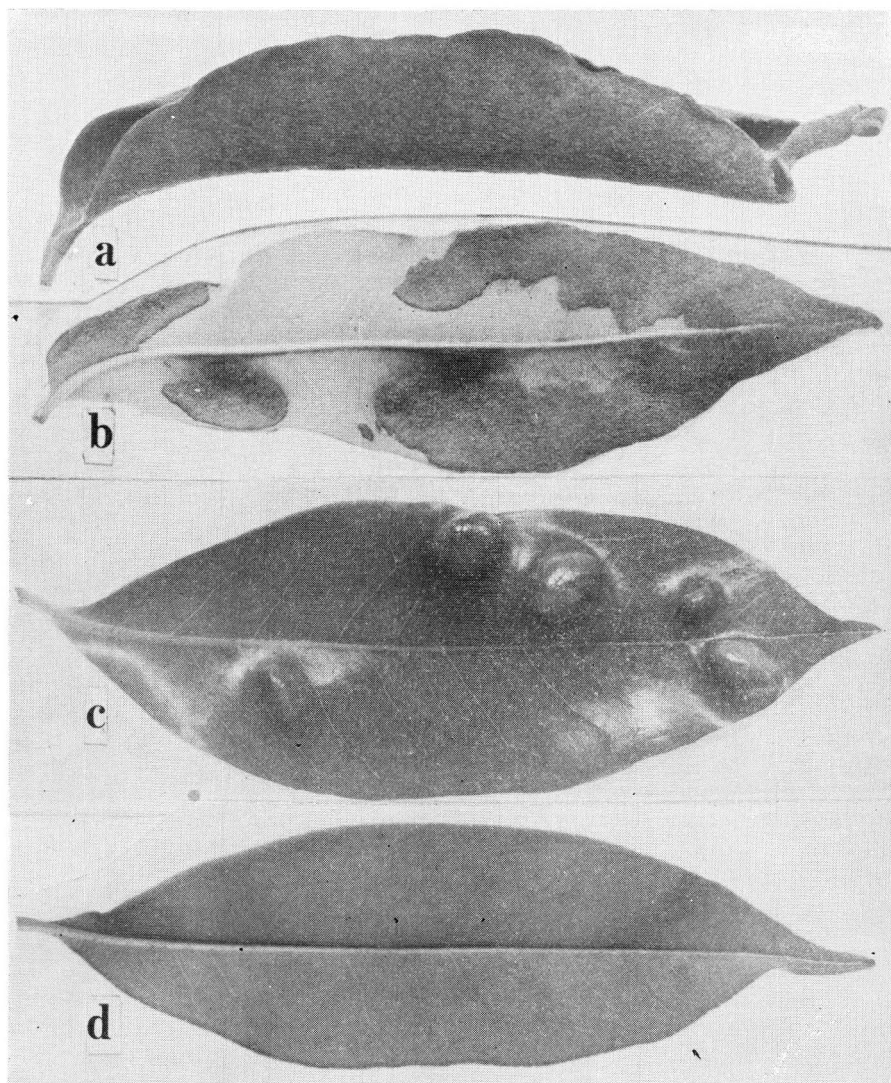


FIGURE 1. Erinose symptoms on lychee leaflets. *a*, Heavily felted leaflet curled upward. *b*, Less severely felted leaflet. *c*, Upper surface of leaflet showing elevated areas resulting from erinose on the under surface. *d*, Lower surface of normal leaflet.

In general the first symptom of erinose is found on leaflets which have just begun to unfold. The first symptom is the appearance of blister-like areas, which are greener than the normal color. Within one or two days these areas are covered with a thick growth of silvery white, felt-like hair. The silvery color changes to light brown and then to a deep reddish brown in approximately three to four days.



FIGURE 2. Lychee tree seriously affected by erinose.



FIGURE 3. Deformed leaflets of tree in figure 2.

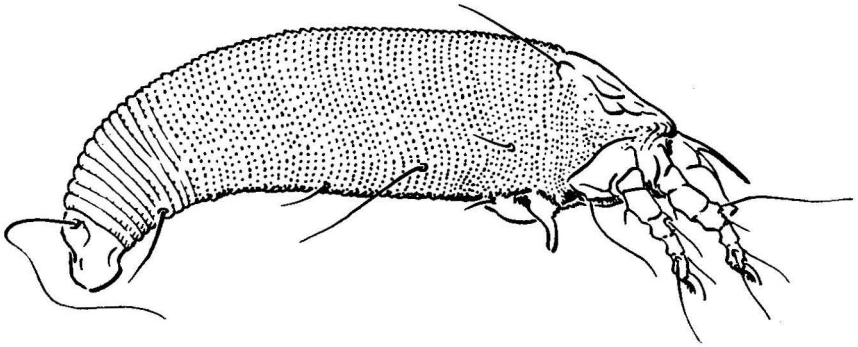


FIGURE 4. The erinose mite, *Aceria litchii* (K.). (Greatly enlarged, actual length approximately 1/200-inch.)

#### IDENTITY, DESCRIPTION, AND BIOLOGY OF THE MITE

The identity of the erinose mite remained uncertain for a long time. According to Higgins (1916), Dr. L. O. Howard identified this mite in 1916 as an undescribed species of *Eriophyes*. Subsequently, the authors submitted specimens of this mite to Dr. H. H. Keifer of the California State Department of Agriculture for identification. Dr. Keifer identified it as *Eriophyes chinensis* Trotter, but stated that the species has never been adequately described. From Hawaii specimens, Dr. Keifer described this mite as *Eriophyes litchii* Keifer (Keifer, 1943). The authors were informed later (*in litt.*, Sept. 20, 1948) that the name of the erinose mite had been changed to *Aceria litchii* (Keifer).

The erinose mite is so small that it cannot be seen with the naked eye. When a leaflet showing newly developed erinose is examined under a microscope, numerous very small mites, approximately 1/200-inch long, may be seen wriggling among the felt. The mite is worm-like in shape (fig. 4) and yellow to red in color.

The life history of the erinose mite is little known. Misra (1912) in his account of the "litchi leaf curl" in India stated that the egg is laid at the base of the felt. The size of the egg has been reported to be comparatively large in proportion to the size of the female. The nymph resembles the adult but is smaller in size. Misra reported that the life cycle of this mite in India does not exceed 14 days. In general this mite is found most abundantly on newly formed felt which is still silvery or pale brown in color. After the felt turns deep brown the mite is no longer present. It therefore seems as if young leaves are necessary for its survival and reproduction.

Examination of lychee twigs and leaflets during the period when there was no new growth failed to reveal the presence of the erinose mite. Yet, during flush growth, symptoms of erinose appeared within a short time. It is not known where the mite is and in what stage it occurs during the period when the tree is not producing new growth.

Apparently the erinose mite is specific to lychee, for it has never been recorded from any other host. A number of plants of the family Sapindaceae to which the lychee belongs, including the cultivated longan,

*Euphoria longana*, occur in Hawaii; however, this mite has never been observed on these plants. Its host specificity indicates that infestation can result only from the movement of the mite from infested to uninfested lychee plants.

### SEASONAL OCCURRENCE

In order to determine whether there was a seasonal prevalence of erinose, trees in the vicinity of Honolulu were examined at monthly intervals throughout the year. A limited number of observations were made also on trees located in other areas of Oahu and on other islands.

The results of these examinations indicate the months in which newly developed erinose was found in Honolulu (fig. 5). The incidence of erinose was highest during November to May; because erinose develops only on new growth, the occurrence of erinose coincided with the period when the trees produced new growth. Furthermore, although it was observed that in the vicinity of Honolulu felting generally occurred during October to May, in other localities erinose may occur at other times—in areas outside Honolulu trees with newly developed erinose have been observed even during July, August, and September. Therefore, it should be noted that erinose may occur whenever the tree flushes, regardless of locality or season of the year.

### CONTROL BY PROPERLY TIMED SULFUR SPRAYS

Observations have shown that the abundance of the mite and the inci-

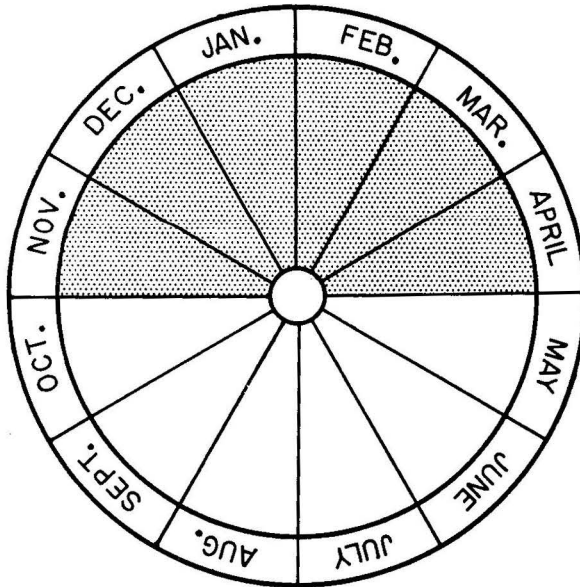


FIGURE 5. Seasonal prevalence of erinose in the vicinity of Honolulu. Stippled areas represent periods in which newly developed erinose was found.

dence of erinose were greatest at the time of flushing. Following this observation, an attempt was made to determine whether effective control can be obtained by proper timing of the spray applications. Trees with symptoms of erinose from the previous year were sprayed with wettable sulfur at the rate of 5 pounds per 100 gallons of water when the new shoots had begun to emerge. After this first spraying, four successive applications of sulfur at the same rate were made at monthly intervals, a total of five applications per year. This small-scale experiment showed that erinose can be effectively controlled by this procedure.

No further tests were made; however, several backyard growers who had used this procedure also found it effective. This method has also been effective in a large orchard of several hundred trees at the HAES Poamoho Experimental Farm. Because of the variation in the time of flushing, sulfur sprays were applied whenever the trees were found flushing. According to Mr. S. Nakata, HAES junior plant physiologist, three to four applications per year has given satisfactory control of erinose in this orchard.

The quantity of spray necessary for each tree depends on a number of factors: tree size, density of foliage, type of sprayer used, and thoroughness of application. Because of these factors, it is difficult to estimate the required quantity of spray. However, as a guide in estimating the volume required, approximate quantities of spray that have been used on trees of various sizes is given in table 1. Table 2 lists the calculated amounts of wettable sulfur required to prepare the various quantities of spray.

Several types of equipment may be used to apply the spray. The equipment to be used will depend on the size of the tree, the number of trees, and, of course, the equipment available. On small trees, an ordinary hand-operated garden sprayer may be used conveniently. On medium to large trees, although small hand-operated equipment may be used, a more rapid and satisfactory coverage is obtained with power sprayers.

Tests were not made with sulfur dust because of the lack of suitable equipment. However, there appears to be no reason why this dust would not be effective if applied at times favorable for dusting and with equipment which gives suitable coverage.

TABLE 1. Approximate quantity of spray required for trees of various dimensions.

RELATIVE SIZE OF TREE	APPROXIMATE DIMENSION OF TREE		SPRAY REQUIRED
	Height	Average spread	
	<i>feet</i>	<i>feet</i>	<i>gallons</i>
Very large . . . . .	40	35	50
Large . . . . .	30	30	25
Medium . . . . .	13	18	8
Small . . . . .	6-8	6-10	4



TABLE 2. Quantities of sulfur necessary to prepare sprays with a concentration of 5 pounds of sulfur per 100 gallons of water.

QUANTITY OF SULFUR	TOTAL VOLUME OF SPRAY					
	2 gals.	5 gals.	10 gals.	20 gals.	50 gals.	100 gals.
Weight measure	2 oz.	$\frac{1}{4}$ lb.	$\frac{1}{2}$ lb.	1 lb.	$2\frac{1}{2}$ lbs.	5 lbs.
Volume measure	$\frac{3}{8}$ cup*	$\frac{3}{4}$ cup	$1\frac{1}{2}$ cup	3 cups	$7\frac{1}{2}$ cups	15 cups

\* A cup with a capacity of 8 fluid ounces.

## DISCUSSION OF CONTROL

In erinose control it is important that the treatments are made at the time of flushing. The time of flushing, however, varies with climate, soil, variety, and cultural practices. It is desirable, therefore, that growers observe the flushing behavior of their trees, and time the treatments accordingly.

Some growers were disappointed that erinose did not vanish soon after sulfur was applied. It should be pointed out that the sulfur treatment is not a cure for erinose—no treatment can free a tree of erinose already formed. This treatment is a preventative measure which destroys the erinose mite before it can cause the development of erinose on new foliage. Thus, protection from erinose can be obtained only if sulfur is applied to the tree when it is just beginning to flush and before the mite has caused erinose.

Because of the effectiveness and low cost of sulfur, no efforts have been made to determine the effectiveness of some of the new miticides in controlling erinose. If applied at the proper time, many of these miticides would no doubt prove to be effective.

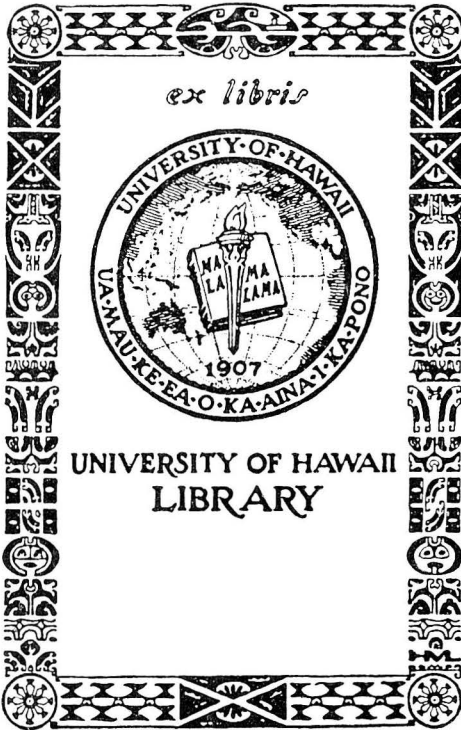
## SUMMARY

The erinose mite, *Aceria litchii* (Keifer), is one of the important pests of the lychee, *Litchii chinensis* Sonn., in Hawaii. The abundance of this mite and the incidence of erinose caused by it are greatest during the period of flush growth in the lychee. The mite can be effectively controlled by applying wettable sulfur at a rate of 5 pounds per 100 gallons of water at the time of the emergence of new growth. After the initial treatment, two or three additional treatments at monthly intervals may be necessary for effective control.

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