OCCURRENCE OF BREVIPALPUS MITES, LEPROSIS, AND FALSE LEPROSIS ON CITRUS IN FLORIDA[1]

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ABSTRACT

An 18-year survey of *Brevipalpus* mites on citrus was analyzed to account for the almost complete disappearance in Florida of leprosis (nailhead rust, Florida scaly bark). *B. californicus* (Banks), the mite responsible for leprosis in Florida, was found occasionally on citrus in various parts of the State, but only in Volusia County and in Sumter County was it accompanied by leprosis. *B. obovatus* Donnadieu, the cause of leprosis in South America, was encountered twice on citrus (a new host record for the State), but symptoms of leprosis were not in evidence. In caged experiments, however, *B. obovatus* did produce leprosis. *B. phoenicis* (Geijskes) was found on citrus throughout the State, often in large numbers, but no economic consequences attended infestations. A description is given of "false leprosis," a disorder of unknown etiology that is often mistaken for leprosis.

HISTORICAL REVIEW

Leprosis (Fig. 1) limits the production of citrus in certain areas of the world. In Argentina, Paraguay, and Uruguay, thousands of acres of orange trees have been abandoned because of this mite-induced trouble.

Leprosis was first observed in Florida in the 1860s. From its focal point in Pinellas County, it radiated to other citrus-growing areas, and by 1917, 9 counties contained affected trees. The seriousness of the problem was memorialized by the quarantine of 12 March 1917 which attempted to halt the spread of leprosis by confining nurserystock movements within affected counties. Notwithstanding this measure, leprosis continued to spread; by 1925, it was known in 17 counties.

A sudden reversal took place in the late 1920s; leprosis began to disappear. By 1948, the trouble was no longer known in the State except for a few unsprayed groves in Volusia County's Turnbull Hammock, from Oak Hill to Daytona Beach.

The disappearance of leprosis appears to have coincided with the increased use of sulfur in the late 1920s for combatting citrus rust mite. Spray trials in 1949-1950 (Knorr and Thompson 1954) demonstrated the marked effectiveness of sulfur in controlling *Brevipalpus californicus* (Banks), the false spider mite associated with leprosis in Florida (Knorr 1950).

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Recent reports of leprosis and false leprosis

In the late 1950s, sulfur was replaced in many groves by zineb, a material subsequently found to be ineffective for combatting false spider mites (Knorr 1959, 1965). Following the abandonment of sulfur, a leprosis-like spotting of fruits and leaves appeared in some zineb-sprayed groves—a development that raised fears about the re-establishment of leprosis. A number of reports from the Ridge section of the State were investigated; all such cases, however, proved to be "false leprosis" (Fig. 2), a trouble first encountered in Hillsborough County in 1949. While symptoms on fruit and leaves closely resemble leprosis, false leprosis causes no lesions on shoots, twigs, or branches, it is not accompanied by *Brevipalpus* mites or casts, and it fails to re-appear in affected trees in subsequent years. In further contrast to leprosis, which affects only early and midseason varieties of sweet orange, false leprosis is seen only in 'Valencias'. The cause of false leprosis is not known.

A new outbreak of leprosis was encountered recently by the third author at Wildwood. Early and midseason varieties of sweet oranges were affected; no symptoms were seen on adjacent 'Valencia' trees. Mites associated with the outbreak proved to be *B. californicus*. Spraying in this grove had been limited to occasional applications of zineb.

Occurrence of false spider mites on Florida citrus

The rise and fall of leprosis in Florida has long posed an enigma. Undoubtedly the increasing use of sulfur for rust-mite control contributed to the general disappearance of leprosis. But why did leprosis disappear also in unsprayed and abandoned groves? The answer does not seem to lie in the disappearance of *B. californicus;* a previous report (Knorr 1959) showed this species widely distributed on other hosts including azalea, angel's-trumpet, croton, ground cherry, guava, mimosa, privet, and spanish needles.

Does the disappearance of leprosis correlate with the disappearance on citrus of *B. californicus*? Records of false spider mites on rutaceous plants have been kept since 1949. Results of a recent survey together with results from a survey reported earlier (Knorr 1959) are given in Fig. 3. Findings based on both surveys are as follows:

1. False spider mites are common on citrus throughout the State. At times, infestations are so heavy that a thousand mites may be found on a single fruit.

2. The species almost invariably encountered is *Brevipalpus phoenicis* (Geijskes). Of 129 collections of false spider mites from over the State, 106 proved to be this species. This is in agreement with findings of Muma (1965) who reported that *B. phoenicis* is abundant in all citrus-growing areas, and that with the exception of *Phyllocoptruta oleivora,* it is the most frequently encountered mite on Florida citrus trees that are not usually sprayed.

3. The following rutaceous hosts were found infested with *B. phoenicis*: *Citrus aurantium* L., *C. limon* (L.) Burm. f., *C. mitis* Blanco, *C. nobilis* Lour., *C. paradisi* Macf., *C. reticulata* Blanco, *C. sinensis* (L.) Osbeck, *C. sinensis* x *reticulata* ('Temple'), *C. paradisi* x *reticulata* (tangelo), *Aeglop-*

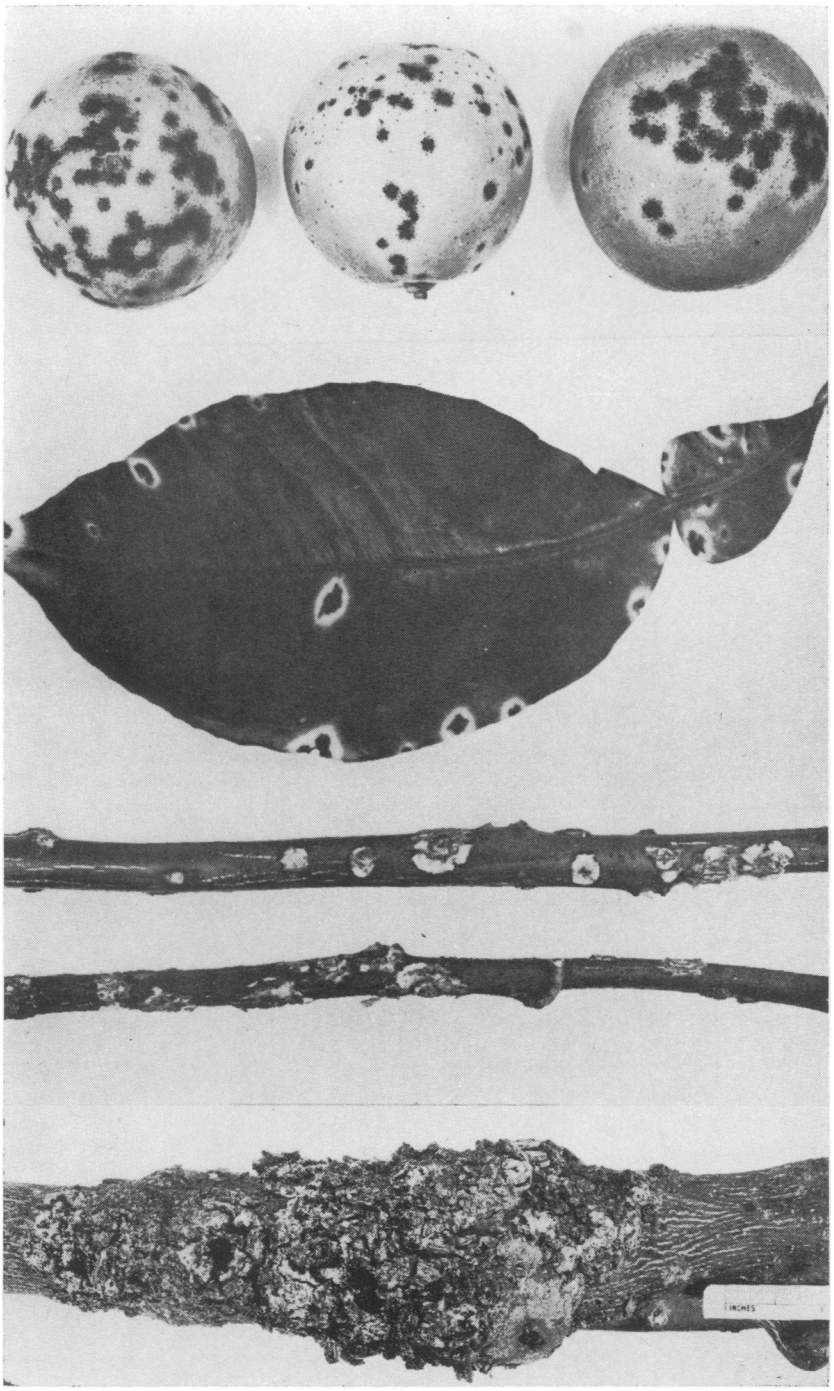

Fig. 1. Leprosis (=Florida scaly bark, nailhead rust) as it appears in Florida on fruit, leaves, twigs, and branches. Lesions grow apace with increasing diameter of twigs; in time, branches and even trunks may become girdled. The incitant is *Brevipalpus californicus* (Banks), but it is still not known whether this disease results from a mite-injected toxin or from a mite-vectored virus.

sis chevalieri Swing., *Atalantia ceylanica* (Arn.) Oliv., *Hesperethusa crenulata* (Roxb.) Roem. The following hosts were found infested with *B. californicus*: *Citrus aurantium* L., *C. limon* (L.) Burm. f., *C. paradisi* Macf.,

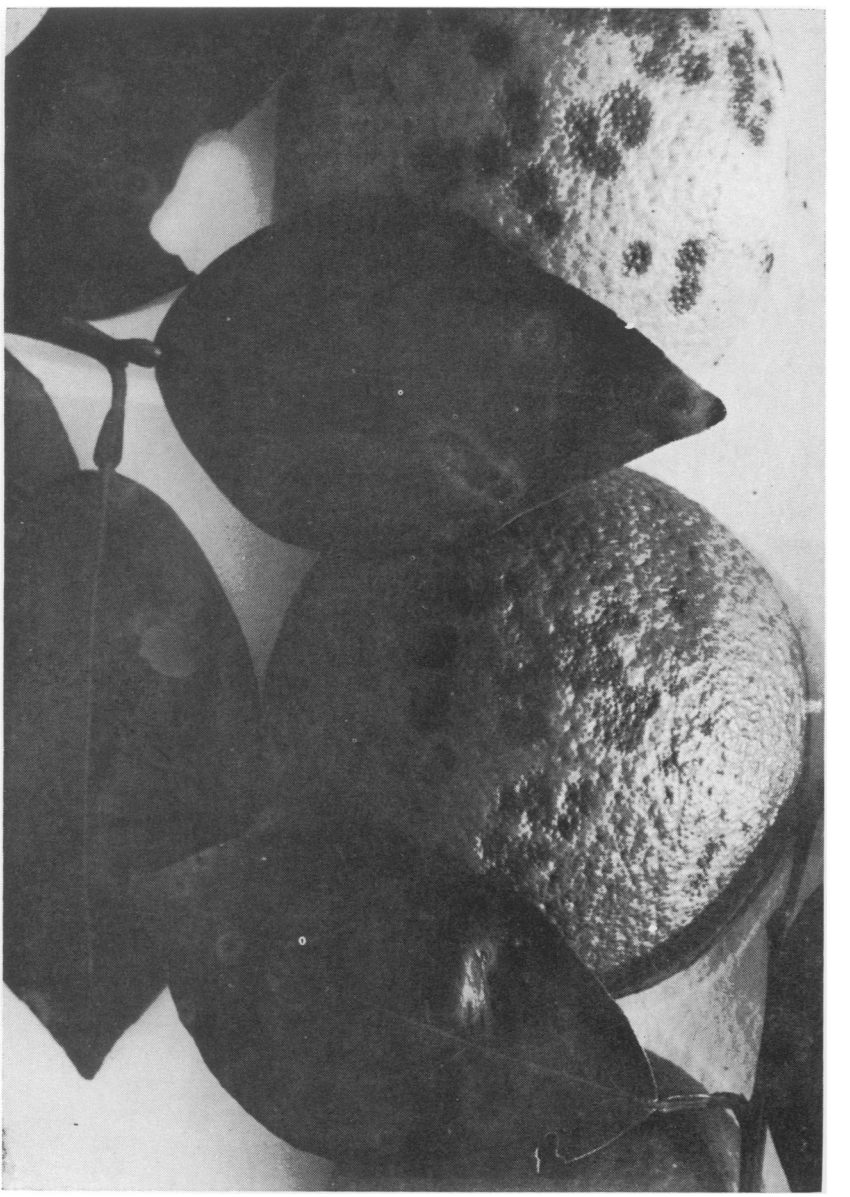

Fig. 2. False leprosis. Lesions on fruit and leaves resemble leprosis in color, size, and consistency, but twig lesions do not occur with false leprosis, a trouble of unknown etiology.

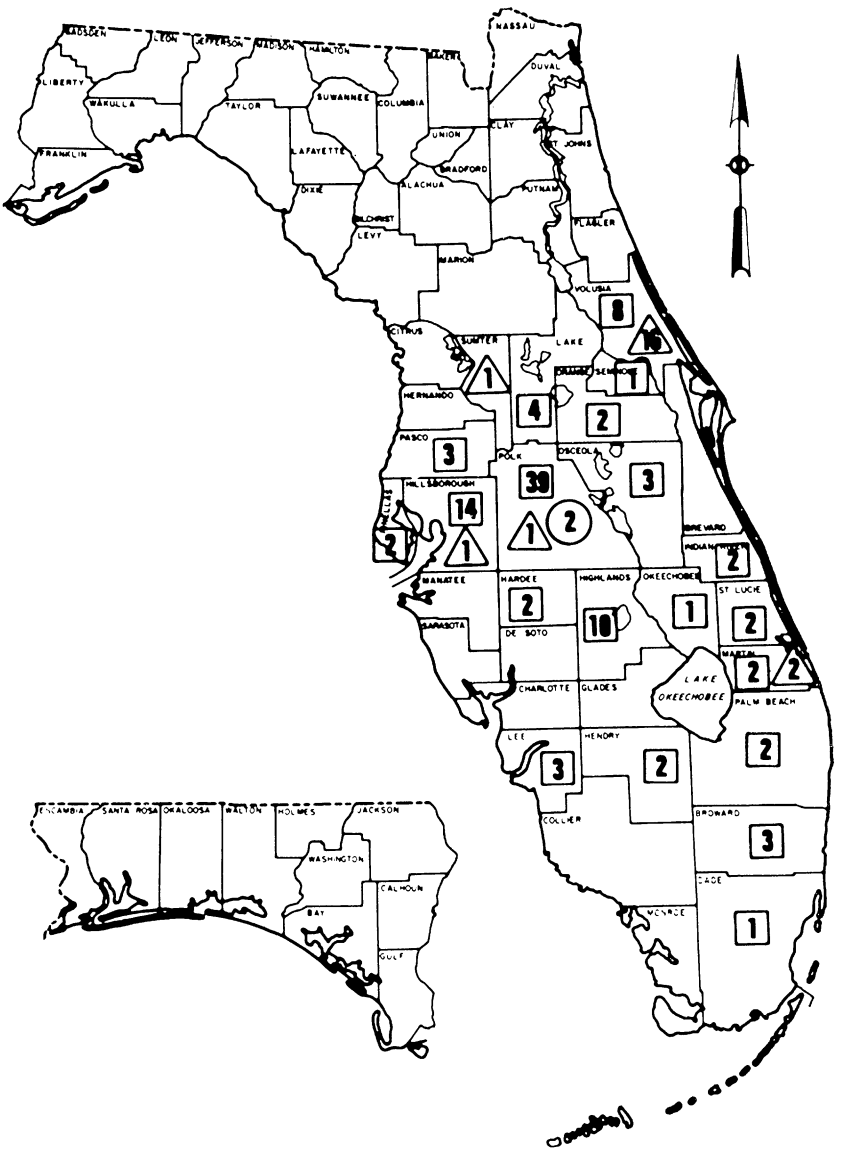

Fig. 3. Distribution in Florida of *Brevipalpus* spp. on rutaceous hosts. Figures within following symbols indicate the number of times the species was encountered:

□=*B. phoenicis* (Geijskes). △=*B. californicus* (Banks).

○=*B. obovatus* Donn.

C. sinensis (L.) Osbeck, *C. sinensis* x *reticulata*. *B. obovatus* was found twice, once at Winter Haven on *Citrus limon* (L.) Burm. f. and once at Auburndale on *C. sinensis* (L.) Osbeck.

4. On the basis of 129 random collections of brevipalpids, it appears that *B. californicus* is mostly restricted to northern sections of the State, though it was occasionally encountered in the central, western, southern, and eastern districts. In 1961, Muma (1961) stated that this species had not been found outside Turnbull Hammock, but in 1965, on the basis of more extensive records, he reported it common to abundant in groves of the north and northeast coast districts (Muma 1965).

5. The presence of *B. californicus* at Loughman, Ruskin, and Stuart was not accompanied by leprosis, presumably because hosts (respectively, 'Valenica', 'Temple', and rough lemon) were varieties insusceptible to leprosis.

6. *B. obovatus* Donn. (syn. *Tenuipalpus pseudocuneatus* Blanchard), the species responsible for leprosis in South America, was encountered twice, both times in Polk County. These are new records for this species on citrus in Florida. Hosts were *Citrus limon* and *C. sinensis* cult. 'Valencia'—varieties known to be insusceptible to leprosis. *B. obovatus* occurs, however, on other hosts in Florida, including various weeds in citrus groves. One collection from spanish needles was transferred to caged seedlings of 'Pineapple' sweet orange; in due time, *B. obovatus* led to the development of leprosis (Knorr, unpublished data). Muma (1965) had earlier reported finding no *B. obovatus* on citrus, concluding that this species is uncommon or rare in Florida on *Citrus* spp.

On the basis of the above described collections, it would seem that leprosis is no longer found on Florida citrus because *B. californicus* is no longer present on susceptible host varieties. About a third of the collections were made in abandoned groves; therefore, it seems unlikely that the decline of *B. californicus* is attributable to spraying. Neither is it likely that the disappearance of *B. californicus* is due to changing environments; leprosis and the causal mite are still destructive in two disparate ecological niches, at Oak Hill on the Indian River and at Wildwood on the Ridge. Nor is it convincing to attribute the disappearance of *B. californicus* to biological control since Muma (1965) found no evidence that *Brevipalpus* mites are attacked by insects, mites, or fungi.

Though reasons for the disappearance of leprosis remain uncertain, measures for control are well established (Jeppson et al. 1955, Knorr 1965, Knorr and Thompson 1954). An annual postbloom application of either wettable sulfur (10 lbs/100 gallon of water) or chlorobenzilate (1/4 pint of 45.5% liquid/100 gallon) controls both mite and disease.

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