The Potential Use of Eriophyoid Mites for Control of Weeds

by
Dr. Harvey L. Cromroy[1]

ABSTRACT

The unique characteristics of mites belonging to family Eriophyidae, superfamily Eriophyoidea are presented in relation to their potential use in the biological control of weeds. Examples are given of their host specificity and arguments made for their strong consideration as an adjunctive organism in the biological control of weeds.

The unique characteristics of the superfamily Eriophyoidea make them strong candidates in the consideration of biological control of weeds. To best explain their potential for weed control, I will begin by summarizing a number of characteristics of the superfamily and then illustrating these characteristics on a species, a pest species, which has been well studied by our group and then finally some of the species which we consider candidate species in biological control of weeds.

Eriophyoid mites are distinguished from all other members of the Acari by some very obvious general morphological features. Eriophyoid mites have only two pairs of legs, a worm-shaped body with what appears to be annular rings running behind the cephalothorax, called thanasomol rings. This group of mites are all phytophagous and many are very host specific restricted to either plant species within one genus or even to a single species within the genus. The mites are also very small in size ranging between 100 to 400 microns in length. It is the family Eriophyidae within the superfamily Eriophyoidea that has the greatest potential in consideration of weed control. This family includes mites which are gall makers, producers of erinea, and rust mites.

There is much information which is still lacking on the basic biology of the eriophyoid mites. I have summarized some general facts in the following paragraph. The eriophyoid mites have preferred site locations on the plants and this applies to both the gall makers and the erinea makers. The eriophyoid cheliceral stylets can penetrate plant tissue only to a depth of 25 to 50 microns. We also know that when the gall maker produces a gall that the growth modification is initiated only on embryonic plant tissue and that the substance produced by the mite and injected into the plant is very localized. In the cases of those mites which produce erinea there is a lateral dispersion of the substance produced by the mite within the leaf. The eriophyoid mites are typically pests of perennials but they do infest annuals also. Some authors believe that the members of the family Eriophyoidea have a very narrow host range especially on the broad leaf plants and many, and by many I mean according to some authors over 95% of the species of Eriophyidae, are restricted to a single genus of plants and within this grouping of 95% possibly 40% of this number are restricted to a single genus and species of plant. An additional feature of the Eriophyoids is the fact that they have already been recognized to carry ten different plant viruses (Whitmoyer, 1972). The best way of emphasizing the potential of this group of mites in weed control would be to describe the effect of one species on an economic crop since the economic species have been better studied than those on weeds. The species I will discuss in some detail is the Bermudagrass mite, *Eriophyes cynodoniensis* (Sayed) (Jeppson *et al.*, 1975). Scanning electron microscope pictures of the mite are provided in Figure 1 and 2. Figure 1 illustrates the major characteristics of the eriophyoids and Figure 2 provides a photo of the shield which is one of the key characteristics in identification to species. The Bermudagrass mite is distributed throughout the entire state of Florida and has also been reported from California, Arizona, Texas and Georgia. Florida has a very large area in turf approximately 900,000 acres which includes golf courses, commercial areas, cemeteries and home lawns as well as sod growers (Survey, 1976). This mite when present in large numbers can cause stunting of the grass and with secondary stress will kill grass. It is found only on Bermudagrass and especially on four varieties, St. Lucie, Ormond, Common and No-Mow. These four varieties are some of the most common grasses planted in Florida. Work done by Dr. F. A. John-

[1]102 Newell Hall, Dept. of Entomology & Nematology, IFAS, University of Florida, Gainesville, FL 32611.

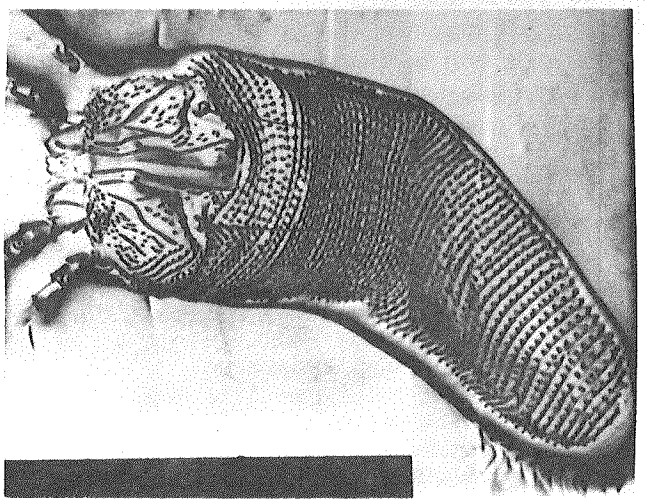

Figure 1. A Scanning Electron Microscope (SEM) photo of the mite, Eriophyes cynodoniensis (Sayed), the Bermudagrass mite.

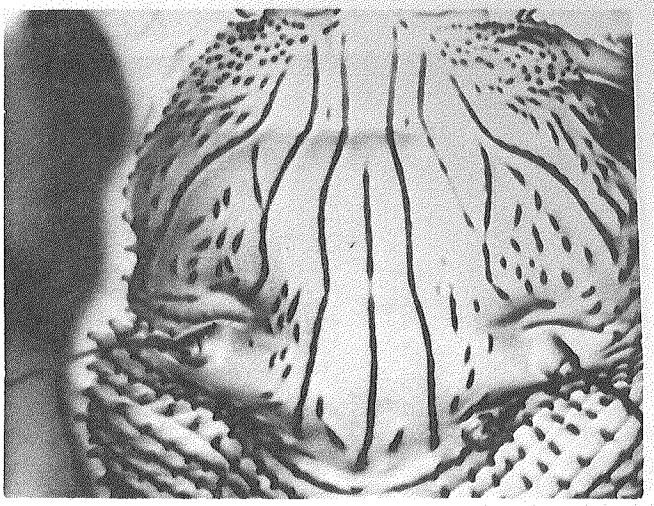

Figure 2. An SEM enlargement of the dorsal shield of the Bermudagrass mite showing the characteristics of the shield design and dorsal setae.

son and myself (1975) indicated that this mite will grow and develop only on these four strains of bermudagrass but will not grow on any of the hybrid strains grown or developed at Tifton, GA with the mixed parentage from Africa which would include *Cynodon transvaalensis* Davy as a parent. This particular mite points out the high degree of specificity found in the eriophyoids where the mite will infest only strains of bermudagrass which come from *Cynodon dactylon* (L.) parentage but not from a mixed parentage which includes the hybrid species Tiftway (419) and Tiftgreen (328).

In the state of Florida we have found three different species of Eriophyoids on three weeds in our preliminary examination of Eriophyoids for the state. One species was found on *Lantana camara,* one on *Mikania,* and one on poison ivy. The damage done to *Lantana* in the north and northcentral part of the state is to produce large galls which consist of a mass of very small green leaves, and distorted flowerbuds and flowers.

This mite, *Eriophyes lantanae* Cook was redescribed by Keifer and Denmark in 1976 and a scanning electron microscope picture done by Cromroy is provided in Figure 3. The damage on *Mikania* found in the southern portion of the state is to produce a silvering and dropping of the leaves. The mites found on poison ivy are primarily makers of erinea and according to observations made by Dr. D. H. Habeck will produce a general dwarfing or stunting of the plant. All three species belong to the family Eriophyidae and all three are in the genus *Eriophyes*. There is a high probability that the *Lantana* mite and the poison ivy mite are probably very specific because of the type of damage which they do whereas the *Mikania* mite may well be a little broader in its host selection. A major problem in the evaluation of these mites for selection in biological control is not only their host specificity but a measure of the decline in vigor which they will produce in the weed. This type of measurement or parameter is one of the most difficult to evaluate for the eventual decision as to the success or failure of the Eriophyid.

In any consideration of the Eriophyids for biological control of weeds one can then look on the positive aspects of these mites. Feature would include the following.

1. high degree of host specificity
2. the mites are wind dispersed
3. they have a very selective site preference as to where they will find feed
4. they generally produce a slow decline in the plant physiology
5. large numbers can be accommodated in very, very small spaces
6. they can be used quite easily in conjunction with other agents, such as pathogenic plant microorganisms or other insects and will not be competitive with these other agents.

On the negative side would be the two items where zero is known - the mite physiology and mass culture techniques. Mass culture techniques have been done exclusively by rearing the mites on live material than transferring live mites by grinding up the material to another medium.

In summary a number of advantages for the use of Eriophyids as an adjunctive organism in

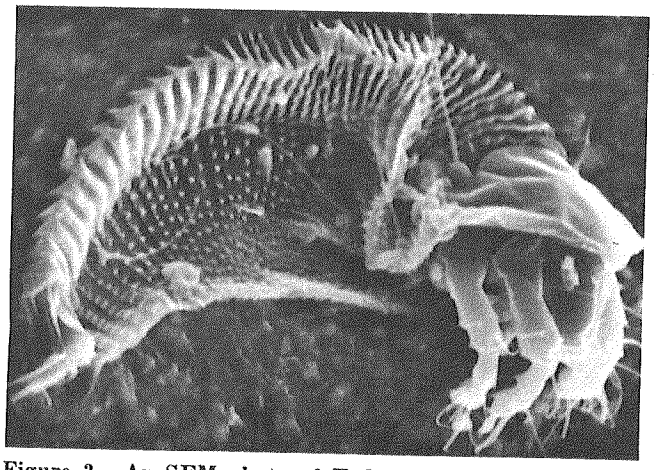

Figure 3. An SEM photo of E. lantanae.

the biological control of weeds has been presented. The success of the Eriophyoid used in Australia on the skeleton weed would seem to be a strong indicator for the future use of Eriophyoids with other organisms in biological control of weeds. The fact that the mites do produce a gradual decline in the plant would make the mites themselves not a single organism for control but always an adjunctive organism to be used with any other system that was on going. It may well be that certain species of Eriophyoids will be the only organisms that will exert any biological control on some weeds.

REFERENCES

Cromroy, H. L. and F. A. Johnson, "A New Look at the Bermudagrass Stunt Mite in Florida". Florida Turf, Vol. 6(2): 5-6, July, 1972.

Jeppson, L. R., H. H. Keifee, and E. W. Baker, *Mites Injurious to Economic Plants.* Univ. Calif. Press, Berkeley, Calif., pp. 327-394, 1975.

Johnson, F. A. "The Bermudagrass Mite, *Eriophyes cynodoniensis* (Sayed) (Acari: Eriophyidae) in Florida with Reference to its Injury Symptomology, Ecology and Integrated Control", Doctoral Dissertation, Dept. Entomology & Nematology, Univ. of Fla., 1975.

Keifer, H. H. and H. A. Denmark, *Eriophyes lantanae* Cook (Acarina:Eriophyidae) in Florida. Entom. Circ. 166, Fla. Dept. Agr. & Consumer Serv., D. P. I., April, 1976.

Florida Turfgrass Survey 1974. Published by Fla. Dept. of Agr. & Consumer Serv., Div. of Marketing, 39 pages, February, 1976.

Whitmoyer, R. E., L. R. Nault, and O. E. Bradflute, "Fine Structure of *Aceria tulipae*". Ann. Ento. Soc. Amer. 65(1): 210-215, 1972.