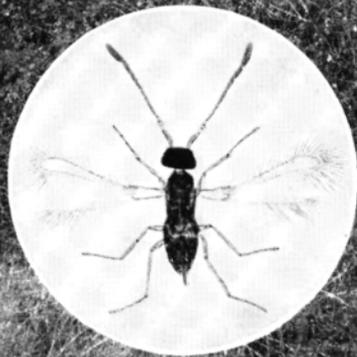


Parasites for control of GRAPE LEAFHOPPER



Overwintering refuge for parasites of grape leafhoppers. Wild blackberry under dormant willow tree in foreground. Napa Valley vineyard in background. The wasp parasite, *Anagrus epos* Girault (microscopic projection), shown in inset.

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Under certain California conditions, a tiny, nearly microscopic wasp parasite, *Anagrus epos* Girault, is capable of holding population levels of the grape leafhopper, *Erythroneura elegantula* Osborn, down to noneconomic levels.

THE PARASITE *Anagrus* is particularly effective in the control of the grape leafhopper because it has a highly developed searching capacity and can find most of the host eggs that have been deposited on grape leaves. In vineyards where it has been encouraged to work, few if any grape leaves escape inspection and by the middle of the summer, almost all of the host eggs have been entered and the leafhoppers killed. The parasitized eggs turn red in color, and this evidence is used in the fields to indicate *Anagrus* activity.

The parasite appears early in the season and becomes quickly established if the environment is suitable. *Anagrus* has good powers of dispersal and produces approximately three large generations of parasites to one of its host leafhopper. Where the parasite is active in vineyards for an entire growing season, the third generation of the grape leafhopper is nearly eliminated.

The grape leafhopper appears to have evolved naturally on the wild grape, *Vitis californica* Benthham, which grows along streams, rivers and drainage systems in central and northern California. The egg

parasite breeds throughout the year on a noneconomic leafhopper, *Dikrella cruentata* Gillette, which is found on wild blackberries (*Rubus* spp.). Early in the spring, the great increase in the numbers of *Anagrus* tends to coincide with the first egg laying by the grape leafhoppers. In the undisturbed relationship of wild grapes with wild blackberries, where the two plants grow in the same habitat, they are often even intertwined. The *Anagrus* from the blackberries, therefore, very easily finds and attacks the grape leafhopper eggs on the wild grapes. This feeding continues throughout the summer as long as the grape leafhoppers continue to oviposit. This same sequence of events occurs each year, and for this reason, there are no large populations of grape leafhoppers on wild grapes. Vineyards planted close to blackberry thickets tend to receive the most benefit from *Anagrus* each summer. The blackberries not only produce a supply of *Anagrus* all year, but also serve as an overwintering refuge for the parasites.

When commercial vineyards were planted extensively in California, they were understandably not established near blackberries, and the ancient grape-*Rubus* relationship was not maintained. As a result, leafhoppers spread into commercial plantings and remain there all year breeding on the vines in the summer and spending the winter as adults in or near the vineyards on low weeds. The parasite, on the other hand, is unable to remain in the vineyards during the

winter and must instead recede to a blackberry refuge.

Whereas the leafhopper spends all year in a vineyard, the parasite population must spend the winter on *Rubus*, and such an overwintering refuge may be many miles from the vineyards. Thus, the barrier of time and space between the leafhopper and the overwintering source of its effective parasite has created a pest problem for growers.

In the Napa Valley, vineyards are very close to wild blackberries, and annual treatment for control of leafhoppers is not required. Vineyards in the San Joaquin Valley which have effective parasite activity are also invariably associated with some nearby source of blackberries. Farther south, toward Kern County, the leafhoppers become more abundant because the sources of *Rubus* decrease. Efforts are now being made to manipulate the environment to encourage the parasite activity by establishing overwintering refuges for *Anagrus* adjacent to commercial vineyards in the San Joaquin Valley.

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