density of consecutive 5-mm strips is determined with an electronic transmission densitometer (Photovolt) using the appropriate filter. The color densities are plotted against the distance from the starting line, and distribution curves are drawn. The areas under the curves give the approximate content of each amino acid. Standard amino acids, both individually and in mixtures, are run side-by-side with the unknown.

In the case of the two-dimensional chromatograms, the area of greatest color density, multiplied by the area of the spot, gives the concentration of the amino acid when read from a curve prepared in the same way.

This method has been applied successfully for the quantitative estimation of all amino acids in an acid hydrolysate of proteins except for leucine and isoleucine, which, as yet, have not been sufficiently separated.

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Parasites to Aid in the Control of the Sweet Clover Weevil[1]

The idea of importing parasites to help in the control of injurious insects is by no means new. One of the early and outstanding achievements along this line was the introduction of the Vedalia beetle from Australia to California by the U. S. Department of Agriculture in 1888–89. This became established and has been an important natural aid in the control of the cottony cushion scale on citrus fruits. Many other examples of successfully established parasites might be cited. In general, the parasites must be obtained from the land where the destructive species originated, because it is there that they have had the opportunity to develop.

One of the destructive species about which American agriculture has become increasingly concerned is the sweet clover weevil, *Sitona cylindricollis.* This species was first recorded on the American continent near Montreal, Canada, in 1924, having come over from its native Europe in some unknown way, and has since spread over much of the sweet-clover-growing area in the United States and Canada. It is especially destructive to the sweet clover seedlings, often destroying them before they can become established. The damage is largely the result of the feeding on the leaves. This gives the leaves a scalloped effect, but, when severe, the plants may be completely defoliated. The larvae appear throughout the summer as small, white, fat grubs in the soil at the base of the plants, where they feed on the rootlets to stunt the plant's growth.

Measures against the weevil have included the application of insecticides and the use of shallow tillage. Of various insecticides a 3% DDT dust applied to the infested fields early in the spring, at the rate of about 20 lbs/acre, has been most effective. Shallow tillage of sweet clover during early summer destroys many of the larvae and pupae at the base of the plants by exposing them to the sun and heat of the surface soil. Delaying the seedling beyond June 15, when weevil activity temporarily subsides, has been observed to give new seedlings a chance to become sufficiently established to survive subsequent weevil damage.

Through the cooperation of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, the North Dakota Agricultural Experiment Station has recently obtained from France two species of insects which are parasitic on the sweet clover weevil. One is a small, hymenopterous species, *Microctonus aethiops,* and the other is a small, dark-colored fly, *Campogaster exigua.* A few small shipments of both species received during the spring and summer of 1948 were released in cages supplied with large numbers of weevils to be parasitized. The cages were constructed of a 36-mesh plastic screen, a type of material which allows the passage of considerably more light than metal screen of similar mesh and probably contributes to more normal conditions for the caged occupants.

The reaction of the weevils to the parasites was interesting. Even though the weevils on this continent had apparently been separated from their parasites since at least 1924 (24 annual generations of the weevil), they immediately indicated fear when exposed to *M. aethiops.* On one occasion *M. aethiops* was observed to stalk a ''frantically retreating'' weevil for a distance of 30″ in a cage before overtaking it and thrusting an egg into its body. The presence of *C. exigua* in the cages did not cause any observable disturbance of the caged weevils.

H. L. Parker, who supervised the collecting of the parasites, observed that from 20% to 50% of the weevils in the collections were destroyed by *C. exigua* as contrasted with about 4% by *M. aethiops.* If present efforts result in establishing these parasites in this country to the extent that they can shift for themselves, a permanent check on the weevil and an important agency in natural control will have been achieved. The lack of these natural checks on the sweet clover weevil is evidenced by its extensive and rapid spread since its introduction to North America. Where sweet clover formerly thrived the weevil has, in many instances, reduced the acreage of this pasture- and soil-building crop to less than 25% of its former status. To what extent the recently imported parasites are able to become established and effective in checking the weevils awaits to be seen.

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[1] Assisting in this investigation are Marvin A. Leraas and Kenneth S. Engle, students at the North Dakota, Agricultural College.