

setts, but, because of its thinness, has not heretofore been separated from the main or drumlin drift (Montauk) and has even failed of recognition where present on the extensive sandy deposits of the Plymouth and Cape Cod regions of Massachusetts. On Long Island it is better developed and is everywhere recognized above the older gravels. It is presumably to be correlated with the latest drift of the Mississippi Valley—the Wisconsin.

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UNITED STATES GEOLOGICAL SURVEY.

FOOD HABITS OF THE SNAIL *BULIMULUS DORMANI* BINNEY.

THE orange and other *Citrus* species, several ornamentals, and various greenhouse and other plants are often badly disfigured by the presence of a black saprophytic fungus,¹ *Meliola Camelliae* (Catt.) Sacc. commonly known in the orange-growing region of Florida as the 'sooty mold' of the orange. The fungus feeds on a sweet honey dew exuded by various insects, especially species of Aphidæ, Coccidæ and Aleyrodidæ. The habits of the Aleyrodidæ species are very favorable to the growth of the fungus. This is especially true of the so-called 'white fly' of the orange, *Aleyrodes citri*. The larvæ of this species, attaching themselves to the under surface of the leaves, exude honey dew which, falling to the top surface of the leaves and stems beneath supplies nourishment for a heavy growth of the fungus. The white fly and the fungus are invariably associated, and a badly infested grove or hedge may be recognized at some distance by its heavily coated dark foliage. So dense is the covering of the intertwining hyphæ that the smothering layer is believed to interfere seriously with the healthy action of the sunlight on the leaves. The fruit as well as the leaves and stems is coated, and a thorough washing of the smutty oranges becomes necessary before marketing; an added expense is thereby incurred as well as increased danger of bruising from additional handling and washing,

and, unless the oranges are quickly and properly dried, of decay in shipping from the wetting. The presence of the sooty mold is thus one of the most serious results of white fly infection of orange groves, and almost the only appreciable injury from this species to privet and other ornamentals, and is an important element in the injury to various plants from numerous other sucking insects.

The habits of the snail *Bulimulus Dormani* Binney² are of the greatest interest in this connection. This species, the normal food of which is apparently fungi, algæ and perhaps lichens, has been found during the summer of 1905 in numerous groves in Manatee County feeding on the sooty mold. The trees on which the snails are found stand out conspicuously among the surrounding trees by their bright foliage and fruit, and clean trunks, in contrast to the sooty leaves and fruit of the surrounding trees. The work of the snails on orange trees is well seen in the Willis grove of the Manatee Lemon Company near Palmetto, Florida. The trees of this grove are seedlings and reach a height of thirty to thirty-five feet. Snails are present on perhaps seventy-five trees and have completely overrun them from top to base, cleaning the fruit, leaves and trunks. The foliage of the trees not visited by the snails is densely coated by the sooty mold. The snails have not confined themselves to the fungus alone, but have freed the trees from algæ, and apparently some of the lichens. The snails are even more widely scattered in some of the neighboring groves. The species is evidently native to the Florida Peninsula, having been recorded, according to Pilsbry, 'Manual of Conchology,' Vol. 12, 1899, from the mouth of the St. Johns River south to the Caloosahatchee River. The snails appear to have found their way naturally into the groves of the Manatee region. Mr. F. D. Waite, manager of the Manatee Lemon Company, observed their presence on one or two trees in the Willis grove as early as the summer of 1903, and they seem to have appeared in other groves at about the same

¹Saprophytic in the sense that, although following and directly dependent upon various living insects, sustenance is derived from waste products thrown off from the bodies of these insects.

²Kindly identified for the writer by Dr. W. H. Dall.

time. It was not until the summer of 1905, however, that their spread became conspicuous. The snails are active in the early morning while the trees are moist from the dew of the previous night. During the afternoon they gather in sheltered parts of the tree, or under pieces of sacks placed in the tree for the purpose, and are easily transferred in this way from grove to grove. Snails thus introduced into the Harrison grove at Palmetto in March increased in numbers rapidly and thoroughly cleaned the tree on which they were placed by mid-summer.

Considering the fondness of the snails for the injurious saprophytic fungus *Meliola*, it becomes of first importance to inquire into their treatment of the beneficial parasitic fungi. Among the fungi parasitic on orange insects five species in particular are of inestimable benefit to the orange grower. These are: the 'brown fungus'; the red-pink fungus, *Aschersonia aleyrodinis* Webber; a bright red fungus, *Sphærostilbe cocophila* Tul.; the 'gray-headed' fungus, *Opheonectria coccicola* and the 'black fungus.' The first two fungi named are confined to the white fly larvæ; the remaining three are parasitic on the common bark scales of the orange. The brown fungus in its mature stages throws out silvery white hyphæ over the surface of the leaf, and these intertwining with those of the neighboring pustules not infrequently entirely cover the lower surface of the leaf. The snails occasionally feed to a limited extent on these spreading hyphæ, but not so far as observed on the hyphæ of the pustule. Considering the very limited extent to which the snails feed on the hyphæ, it seems probable the spread of the fungus will not be interfered with by the snails. The brown fungus is, as a matter of fact, very prevalent on the trees visited by the snails. The red-pink fungus throws out short hyphæ only; the snails, so far as observed, in no way interfere with this fungus. The red fungus, *Sphærostilbe*, is also apparently untouched, as it is found growing abundantly on the orange trees along with the snails. No opportunity has yet occurred to observe the behavior of the snails towards the gray fungus.

The black fungus,³ however, is found abundantly along with the snails and is apparently untouched by them.

White fly infestation has been severe in the Manatee region for not less than fifteen years, and for an equal or greater time throughout much of the region given by Pilsbry as within the range of *Bulimulus Dormani*. That the snails should be found in orange groves in the Manatee region alone and should have occurred there in sufficient numbers to attract attention or to clean foliage and fruit only within the past three years is suggestive of possible change in food habits of the Manatee River variety of the species, or of an unexplained temporary or permanent reduction of its natural enemies in that locality. During the past winter the snails have been given such protection as they seemed to require, and have been generally distributed throughout some of the large groves in order to further test their usefulness in cleaning up the 'sooty mold' fungus.

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QUOTATIONS.

A NATIONAL DEPARTMENT OF HEALTH.

THE government is designed for the welfare of the people, and in a government like ours, of the whole people, one of the first considerations in the people's welfare is their health; material resources are secondary. Without an able-bodied race, no country can prosper, and it is the favoring health conditions of the temperate zones that have made the races inhabiting them the rulers of the world. With the artificial conditions of civilization, however, the problem of the public health comes more and more to the front, and the old *laissez faire* methods show their deficiencies. More than one country at the present time is seeking methods and means to check the degenerative tendencies that threaten them, and the question whether our civilization is to last seems largely to depend on the success of these efforts.

³ Recently identified as *Myriangium* sp., F. S. Earle, Ann. Rep. Office of Experiment Stations, 1903, pp. 457-8.