leaning and were difficult to classify as vertical or horizontal. The similarity in the data from these three methods would indicate that for most purposes observation of position after fall is a fairly reliable index of position during fall, and that many powdery mildew conidia actually fall with their long axes in a vertical position. Reduction of convection currents is probably an important function of the tube in causing a high percentage of vertical orientation of the conidia and in one test using a narrower tube than the above, all the conidia were found in a vertical position.

Possible explanations for vertical orientation of falling objects are displacement of the center of gravity, rotation about the axis of symmetry and lateral friction due to close approach to the wall of the enclosing container. It has not been determined to what extent any of these could apply to mildew conidia but the writers believe that slight and not clearly observed displacement of the nucleus and vacuoles from a symmetrical arrangement within the spore might account for its vertical orientation under the conditions of the confined air of the small glass tubes.

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THE REQUIREMENTS OF PARASITES FOR MORE THAN HOSTS

The introduction from abroad of beneficial parasites for the control of injurious insect pests may attain even greater success if *all* factors essential to the optimum development of the parasite are studied. For too long the entomologist has centered his attention on the beneficial parasitic stage of the parasite, often failing to appreciate the equal importance of the remainder of its life-history.

Some parasites attack their host in all their active stages, as in the case of the Australian lady-beetle, *Rodolia* (*Novius*) *cardinalis,* which feeds as both larva and adult on the cottony cushion scale, *Icerya purchasi.* Any climatic conditions suitable to the host are equally favorable to its specific predator, with no additional factors necessary, and to this is largely due its outstanding success when introduced originally into California, and later in every other country where the cottony cushion scale has appeared.

This is really the very simplest type of parasite introduction, and the comparative ease with which its success was attained gives little indication of the complications attending that of other kinds of parasites. Most of these attack their insect host either as a larva or as an adult, but not as both, and require some additional factor for survival in their non-parasitic stage. No organism can survive in a new environment where any individual factor essential to its existence is lacking. It is the neglect of this principle, which may be considered almost a biological axiom, that in many cases has prevented other parasites from becoming equally effective in the control of their specific injurious host. The following examples, from the personal experience of the writer, have a more than local application.

The successful introduction into Puerto Rico from Brazil of a large wasp, *Larra americana* Saussure, which is parasitic in its larval stage on a mole cricket, the Puerto Rican "changa," *Scapteriscus vicinus* Scudder, apparently depended on the presence in Puerto Rico of two weeds, locally known as "botoncillo," *Borreria verticillata* and *Hyptis atrorubens,* from the flowers of which only do the wasps obtain nectar. Where these weeds were continuously present in abundance in Puerto Rico, *Larra* became established; where they were scarce or absent, even though changas were present in abundance, the wasps failed to survive. It is possible that some other minor factors may in part have been responsible, but we are not aware of them, and the experiment seems to check as well as one can hope in introductions of this kind.

Instances where there is no successful introduction, but only a series of unexplained failures, are much more numerous, and of these only a single instance need be cited. Repeated attempts to establish the Scarabaeid dung-beetle, *Canthon violaceus* Olivier, of Hispaniola in Puerto Rico were made in 1913, and again more recently. The beetles thrive in captivity, and hundreds of the progeny of those originally brought from across the Mona Passage have been released in Puerto Rican environments that would appear to be identical with those in Hispaniola, yet not one has since been found alive in all the years following. The life-history of these scarabs is apparently so simple that we can not see that anything essential is lacking in Puerto Rico that is present in their country of origin, but it must be so, otherwise how explain their failure to survive.

More instructive are instances of abundant and effective parasites which fail to become numerous elsewhere. Throughout the world, white grubs are attacked by wasps of the genus *Tiphia,* which are often an important factor in control. In Puerto Rico, where endemic white grubs became very numerous and were the major pest of all agricultural crops, admittedly *Tiphia* wasps do exist, but are so scarce that not enough specimens have been collected so that specialists can be sure of their specific identity. In Hispaniola, *Tiphia* is abundant, and along the coast is often collected feeding on the sweet secretions of scale insects and whiteflies. Most of the collections of *Tiphia* in Puerto Rico were made under similar conditions, but in Haiti *Tiphia* is much more often seen frequenting the flowers of wild parsley, *Pastinaca sativa*. At the lower elevations in Puerto Rico, wild parsley does not attain maturity, and even in the mountains must be planted and cared for if one is to have a continuous supply of flowers. At Kenscoff and elsewhere in Haiti, it is a weed that no amount of cultivation seems to discourage. With wild parsley flowers present in abundance at all seasons of the year, *Tiphia* wasps thrive in Haiti, yet barely manage to survive in Puerto Rico, feeding on the excretions of scale insects. The presence or absence of this one factor, important but admittedly not absolutely vital to the non-parasitic stage of their major parasite, apparently determined the relative abundance of white grubs in these two countries.

The coffee leaf-miner, *Leucoptera coffeella,* appears to be present everywhere that Arabian coffee grows, and has numerous minute wasp parasites, generally of very minor importance in its control. On the island of Guadeloupe, French West Indies, Mr. F. Sein found a Braconid parasite, later named *Mirax insularis* by Mr. C. F. W. Muesebeck, which attacks from 65 to 80 per cent. of all the leaf-miner caterpillars. Introduced into Puerto Rico, it has become established, but rarely can one find more than a fraction of 1 per cent. of parasitization. What factor, present in the coffee groves of Guadeloupe, is so scarce in Puerto Rican groves that this parasite, so effective there, can not attain a similar fortunate destiny in Puerto Rico?

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THE COMPLETE UTILIZATION OF SCIENTIFICALLY TRAINED PERSONNEL

IN his recent communication[1] on "Wartime Scientific Manpower Production" Professor Nicholas deals with one phase of a problem which has caused, as he says, "the growing demand for complete utilization of scientifically trained personnel." Scientific teaching which is designed to train new personnel in fields where shortages exist or are imminent furthers the war effort and should therefore be considered as an important duty, as well as an essential war job. There are several other ways through which existing personnel shortages in the various fields of physics could be alleviated. There are many workers in the biological, chemical and geological fields who have the qualifications either for teaching or for war research in physics and who are not as yet doing war work. New teaching personnel could also be found in the ranks of the refugee scientists who are barred from war research because they are non-citizens. Many high-school science teachers are well qualified to teach college courses. In addition, a system for exchange of teaching personnel, such as is already being used by some institutions, could make more teachers available by increasing the efficiency of their utilization.

The above suggestions supplement Professor Nicholas's suggestion of a "personal inventory" with the proposal that the National Roster, or another qualified body, make an inventory of various groups of people who are available to fill the deficit in teaching and research personnel in those fields where shortages exist or are imminent. But it is in relatively few fields that the needs of war research have thus far made a serious drain on scientific manpower. In the field of biology, including the medical and agricultural sciences, and in chemistry mobilization is far from complete. It is chiefly this fact which has caused "the growing demand for complete utilization of scientifically trained personnel," and it was with this phase of the problem that an earlier communication from the American Association of Scientific Workers was concerned. Since the publication of this communication,[2] the AAScW has sent a memorandum (July 30) to the National Academy of Sciences and a letter (Aug. 27) to Dr. Vannevar Bush, the director of OSRD, containing recommendations for specific actions by these two bodies which would aid the mobilization of scientific personnel.

The bottleneck in the full utilization of scientists in the fields mentioned appears to be the difficulty of converting their peacetime research into activity fruitful to the war effort.[3] Many of the war problems in these fields are not obvious to the civilian scientist. Many scientists are therefore awaiting the time when the national scientific authorities will call upon them for specific work. They do not often realize the magnitude of the task which is being done so well by our scientific authorities and many have become discouraged because of the delay in calling upon them for war work. There is hesitation about formulating research projects independently and a paucity of means by which individual or group initiative can be encouraged and made effective. It is feared that independently formulated projects may duplicate work actively in progress and that such independently initiated projects are not wanted by our scientific authorities. Many scientists do not realize that they can themselves make important pioneering contributions to war problems because of their specialized

1 SCIENCE, 96: 2484, 135–6, August 7, 1942.

2 *Ibid.*, 96: 2479, 16, July 3, 1942.

3 This difficulty is not unique for our country but also exists in Great Britain, as can be seen from various editorials in *Nature* and from reports on this question by our colleague, the British Association of Scientific Workers, *e.g., Nature*, No. 3797, August 8, 1942, pp. 186–8.