trol showed complete breakdown within this 5-day period.

Tetrachloroethylene and 1,1,2-trichloroethane also inhibited rot completely but caused some browning of the fruit at a concentration of 1:4,000 and less browning at 1:10,000. Observations suggest that much of this browning could be eliminated by circulating the atmosphere during the period of treatment, as the vapors apparently tend to stratify and settle to the bottom of the treatment containers.

S-tetrachloroethane inhibited all rot development completely at concentrations of 1:4,000 and 1:10,000 but also caused browning of the fruit. There is a possibility that lower concentrations of this chemical might be effective, since laboratory tests *in vitro* indicated that it will inhibit pure cultures of *Rhizopus* spp. and *M. fructicola* at concentrations as low as 1:20,000.

The above findings have been substantiated by pure culture toxicity tests in the laboratory with fungi as well as bacteria and are preliminary to more extensive studies now in progress on the evaluation of volatile chemicals as preventatives for market, storage, and in-transit losses to fruits and vegetables caused by microorganisms.

Manuscript received September 12, 1951.

Hemagglutinins in Caterpillar Bloods

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Although hemagglutinins are known to be present in a wide variety of animals and plants, their occurrence in insects does not appear to have been systematically investigated. During the course of experiments on the Cecropia moth, it was observed that the hemolymph of the larva and pupa of this species exhibits a relatively powerful agglutinating action when mixed with washed mammalian erythrocytes. The agglutinin was found to be present in titers of 1:25 to 1:625 in a large number of larvae and pupae examined, and appeared to be absent from the adult moth and from the egg.

The cecropial agglutinin is a labile substance, its titer being reduced by approximately one half upon heating the hemolymph, at pH 7.0, to 45° C for 1 hr, and by more than 97% at 55° C for 1 hr. It is largely or completely nondialyzable. No hemolysis occurred upon addition of guinea pig complement to mixtures of hemolymph and washed human erythrocytes.

It was of interest to examine other kinds of caterpillars for the presence or absence of hemagglutinin. To this end, specimens of hemolymph obtained from a total of 46 species of lepidopteran larvae,[1] representing 16 families, were tested for ability to agglutinate human erythrocytes. One one-hundredth ml of hemolymph was mixed with 0.04 ml 3% suspension of washed human erythrocytes obtained from a Group O donor. The mixtures were made in transparent glass spot plates, incubated at room temperature, and read at intervals up to 60 min.

The results (Table 1) show that hemagglutinins are present in 10 of the 46 species examined. All the species showing agglutinating action were moth larvae; all the butterfly larvae were negative. Beyond this, however, little correlation between presence of

TABLE 1

PRESENCE OR ABSENCE OF HEMAGGLUTININ IN HEMOLYMPH OF LEPIDOPTERAN LARVAE*

Heterocera		
Protoparce sexta	(8)†	0 to ++
Ceratomia undulosa	(1)	++
Cressonia juglandis	(5)	0
Callosamia promethea	(2)	0
Samia cecropia	(19)	+++
Actias luna	(3)	+ to +++
Telea polyphemus	(3)	0
Automeris io	(7)	0
Citheronia regalis	(8)	0
Dryocampa rubicunda	(4)	0
Anisota senatoria	(2)	0
Unidentified arctiid	(2)	0
" "	(1)	0
Euchaetias egle	(3)	0
Isia isabella	(1)	0
Halisidota tessellaris	(8)	+ to +++
Halisidota caryae	(9)	+++
Acronycta americana	(3)	0
Acronycta sp.	(1)	0
Unidentified noctuid	(1)	0
" "	(1)	0
" "	(1)	0
Symmerista albifrons	(3)	0
Datana ministra	(2)	0
Datana finteggerima	(8)‡	0 to ++
Datana sp.	(3)	0
Hemerocampa leucostigma	(3)	0
Porthetria dispar	(2)	0
Malacosoma sp?	(2)	0
Sibine stimulae	(4)	+++
Prolimacodes badia	(2)	0
Phobetron pithecium	(1)	0
Unidentified cochlidiid	(1)	0
Galleria mellonella	(4)	0
Ephestia kuehniella	(1)	0
Unidentified cossid	(1)	+
" tortricid	(1)	0
" "	(1)	+++
Rhopalocera		
Danais plexippus	(3)	0
Polygonia interrogationis	(2)	0
Aglais antiopa	(2)	0
Papilio troilus	(3)	0
Papilio turnus	(1)	0
Papilio polyxenes	(1)	0
Pieris rapae	(1)	0
Epargyreus tityrus	(3)	0

* Figures indicate number of specimens of pools examined. Zero indicates no agglutination; +, barely visible agglutination; ++, erythrocytes in a great many small clumps; +++, a small number of large clumps; ++++, a single large clump.

† Seven specimens positive and 1 negative.

‡ Five specimens positive and 3 negative.

[1] We are greatly indebted to James King, The Biological Laboratory, Cold Spring Harbor, N. Y., for aid in identification of many of the larvae, to Pauline James and Patricia Moore for help in collecting, and to Alexander S. Wiener for supplying some of the human blood specimens.

TABLE 2

AGGLUTINABILITY OF A-, B-, AND O-ERYTHROCYTES BY HEMOLYMPHS OF *Samia cecropia*, *Halisidota caryae*, AND *Sibine stimulae*

Species from which hemolymph was obtained	Test erythrocytes	Final dilution of hemolymph							
		1:10	1:20	1:40	1:80	1:160	1:320	1:640	∞
Samia cecropia	A	++++	++++	++++	++++	+++	+	0	0
" "	B	++++	++++	++++	++++	+++	+	0	0
" "	O	++++	++++	++++	++++	+++	+	0	0
Halisidota caryae	A	0	0	0	0	0	0	0	0
" "	B	0	0	0	0	0	0	0	0
" "	O	+++	+	0	0	0	0	0	0
Sibine stimulae	A	++	0	0	0	0	0	0	0
" "	B	+	0	0	0	0	0	0	0
" "	O	+	0	0	0	0	0	0	0

agglutinins and taxonomic position is evident, hemagglutinins being present in larvae representing 7 different families. Although the origin and function of the agglutinating substances are not known, the possibility should not be overlooked that the agglutinins may be associated, in some species, with a state of parasitism, for all examples tested of *Protoparce sexta, Ceratomia undulosa,* and *Actias luna* contained hymenopteran or dipteran parasites. Information is lacking as to whether agglutinins are present in unparasitized examples of these species.

TABLE 3

SPECIFICITY OF AGGLUTININS OF *Halisidota tessellaris* AND *Halisidota caryae* FOR GROUP O CELLS

Test erythrocytes	Source of hemolymph			
	*H. tessellaris,** Specimen No. 1	*H. tessellaris,** Specimen No. 2	*H. caryae,*† Specimen No. 1	*H. caryae,*† Specimen No. 2
O, M, Rh_1	+++	++	+++	+
O, N, Rh_2	+	+	0	0
O, –, –‡	+++	++	++	+
A, MN, Rh_z	0	0	0	0
A, N, Rh_1	0	0	0	0
A, –, –	0	0	0	0
B, MN, rh	0	0	0	0
B, M, Rh_1	0	0	0	0
B, –, –	0	0	0	0

* Final dilution of hemolymph, 1 : 5.
† Final dilution of hemolymph, 1 : 10.
‡ Dash indicates M, N, or Rh character unknown.

Hemolymphs from some of the larvae listed in Table 1 were tested for agglutination of A- and B- as well as O-erythrocytes. The results (Table 2) indicate that *Samia cecropia* and *Sibine stimulae* agglutinins fail to differentiate the blood groups, but that *Halisidota caryae* agglutinin acts specifically on O-cells. Further evidence for the specificity of *H. caryae,* as well as of *H. tessellaris,* agglutinin is shown in Table 3. In an additional experiment in which 9 cell suspensions were prepared and coded by an assistant, the three O-suspensions among the 9 were correctly identified by use of *H. caryae* hemolymph. In a few instances, *H. caryae* hemolymph caused a relatively weak and delayed agglutination of A- and B-cells, owing apparently to heterozygosity or to antigen A_2.

Manuscript received September 24, 1951.

First Report of the Presence of a Dermatitis-Producing Marine Larval Schistosome in Hawaii[1, 2]

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Marine snails, identified as *Littorina pintado* Wood, were collected from Moku Manu ('Bird Island'), near Kaneohe, Oahu, Hawaii, on Nov. 24, 1950, and were found to be infected with a species of larval schistosome. The degree of infection among the 40 specimens of *L. pintado* examined was 10%. Because of the difficulty in landing on this island, another bird refuge area known as Manana ('Rabbit') Island, offshore from Oahu, was later investigated. *L. pintado* (Fig. 1), collected from this locality at two different times (March and April 1951), was infected with the same species of marine larval schistosome at a rate of 0–5%, depending on the proximity of the snails to bird droppings washed down from the hillside where various species of marine birds nest. All the *L. pintado* snails containing schistosomes were found in tidal pools. Recent investigations (July 1951) on Mokulua Island, Oahu, indicate that *L. pintado* on the leeward side of this island was not infected with the schistosome, although many dark-rumped petrels (*Pterodroma phaeopygia sandwichensis* Ridgway) were nesting there at the time of investigation.

Penner (*1*) described a marine larval schistosome,

[1] Contribution No. 13, Hawaii Marine Laboratory.

[2] Acknowledgment is made to Wray Harris, marine malacologist, of the Bishop Museum, Honolulu, T. H., for the identification of the marine snails; to J. Donald Smith, game conservationist, of the Territorial Board of Agriculture and Forestry, Honolulu, for the identification of the bird specimens; and to John L. Pelgen and Charles E. Cutress, graduate assistants, of the Department of Zoology, University of Hawaii, for technical assistance.