DISTRIBUTION OF DOMESTIC RATS WITH MURINE TYPHUS ANTIBODIES IN THE UNITED STATES

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When cooperative State-Federal DDT dusting programs were initiated in the southeastern States for control of murine typhus fever, an evaluation program also was initiated to measure results. On these State programs, rats were caught, and blood was drawn from them and tested for the presence of murine typhus fever antibodies. This testing was done by the complement fixation method in all States except one in which the less reliable Weil-Felix method was used. The tests showed that the incidence of typhus antibodies was noticeably less in areas where ectoparasites were controlled than in areas where they were not (figure 1), and that in the former the number of human typhus cases was reduced remarkably. The tests also revealed many facts relative to the percentage of rats with murine typhus antibodies in various parts of the United States.

Four general types of areas are apparent with respect to the geographic or climatic distribution of rats (*Rattus norvegicus* and *Rattus rattus*) in which murine typhus fever antibodies are found.

1. Very favorable. A high percentage of rats from farms and sheds as well as those from towns and/or heated buildings with typhus antibodies.
2. Favorable. A large percentage of the rats from many types of establishments with typhus antibodies, but rats living on farms and/or outdoors generally without antibodies.
3. Marginal. Occasional colonies of rats infected in sheltered places such as particularly favorable buildings.
4. Unfavorable. Few, if any, rats with typhus antibodies (figure 2).

In southern United States conditions very favorable to favorable for typhus infection in both rats and humans exist throughout the greater part of the region in which the average January temperature is above 40°F. and the average relative humidity, noon, July, is above 37 percent. These two areas include the region south and east of a line drawn from Norfolk, Va., through Charlotte, N. C.; Chattanooga and Nashville, Tenn.; Little Rock, Ark.; and Lubbock, Tex. An isolated section of these areas lies in the coastal region of southern California. In Georgia and Alabama the observed dividing line between very favorable and favorable areas is fairly well established along a line drawn through the cities of Augusta, Macon, and Columbus, Ga.; and Montgomery, Ala. In the above two areas the percentage of rats from undusted premises observed with murine typhus complement fixation antibodies was higher than 30 percent in 1946, gradually dropping to 13 percent in 1949 as more and more of the foci of infection were eliminated or modified by DDT dusting. As would be expected,

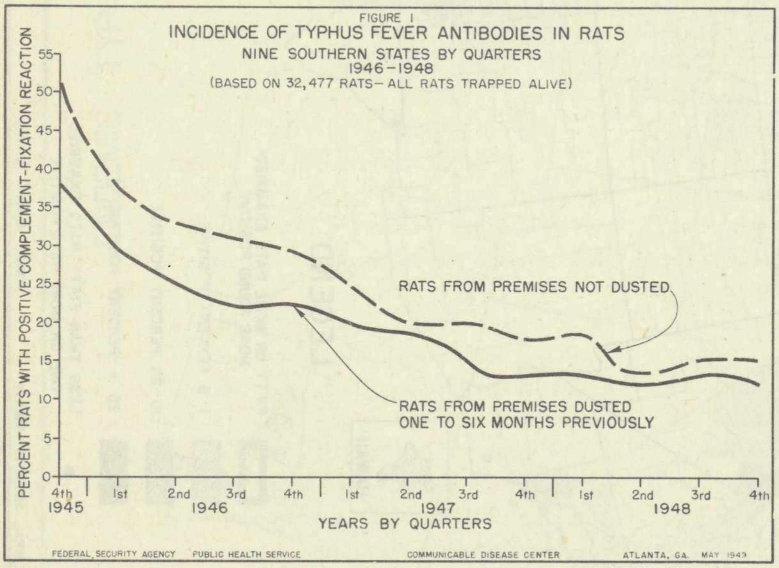

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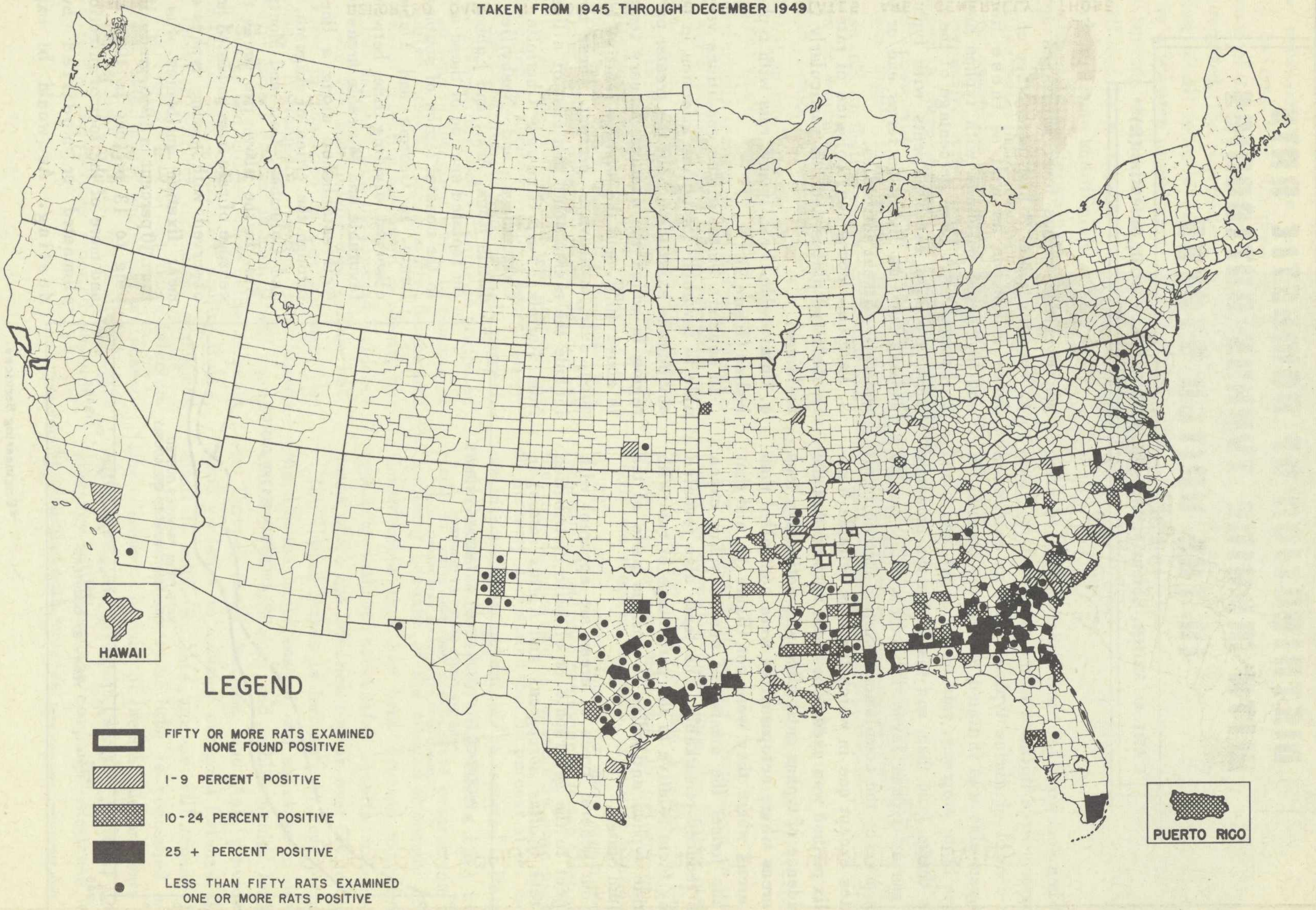
FIGURE 2

INCIDENCE OF MURINE TYPHUS FEVER ANTIBODIES IN NORWAY AND ROOF RATS

TAKEN FROM 1945 THROUGH DECEMBER 1949



FEDERAL SECURITY AGENCY PUBLIC HEALTH SERVICE COMMUNICABLE DISEASE CENTER ATLANTA, GEORGIA DECEMBER 1950

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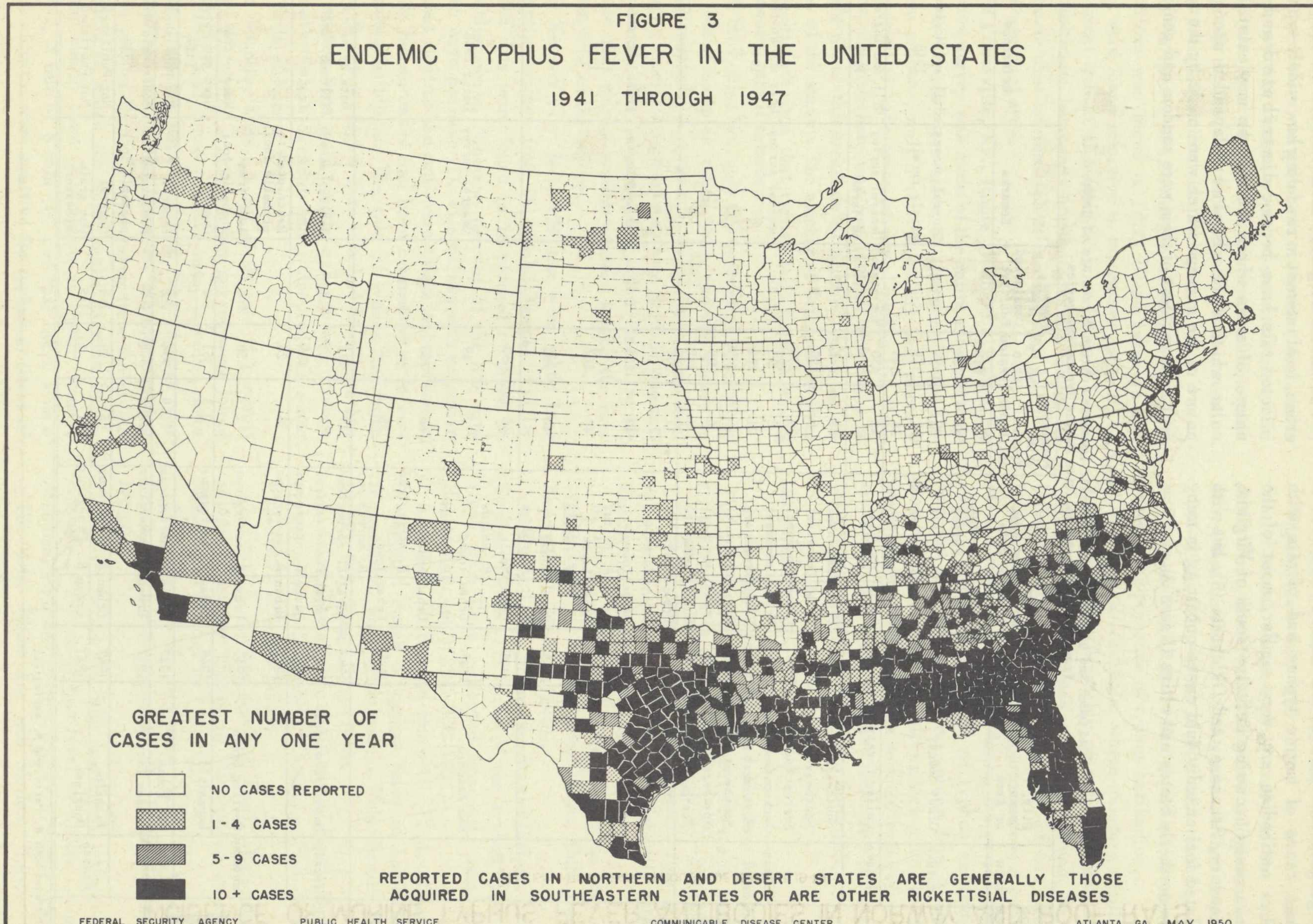

the geographical distribution and incidence of human cases of murine typhus and of rats with typhus antibodies are very similar, most of the human cases occurring in States south of Virginia, Tennessee, Arkansas, and Oklahoma (5), but with isolated foci or individual cases occurring in many more northerly States and cities (figure 3).

The third catergory, which includes the marginal areas, is of interest in revealing how widely typhus-infected rats have become distributed and the nature of areas where the disease may exist. Results which were obtained depended upon the nature of the surveys which were made by the several authors. Most of them were random and general,

TABLE 1

Published and Other Data for Specific Locations on the Percentage of Rats, from Undusted Premises, with Murine Typhus Antibodies

Type of Area	State	City, County, or Area	Year	Urban or Rural	Species (and age) of Rats	Percent with Typhus Antibodies	No. of Rats Tested	Lowest Titer Considered Positive	Remarks	Reference
Very Favorable	Georgia	Grady County	1945	Rural	*R. rattus*	47	241	1:4	General survey, mainly rural	Hill and Morlan 1948
			1946-47	Rural	*R. rattus*	42	929			
			1947-48	Rural	*R. rattus*	35	1428			
			1946-47	Rural	*R. norvegicus*	38	311			
			1947-48	Rural	*R. norvegicus*	38	645			
	Alabama	Coffee County	1944	Rural	Commensal*	42	430	Not Stated	General survey on farms	Hill and Ingraham 1947
	Mississippi	Southeast Quarter	1946	Urban	Commensal	23	448	1:8	General survey	Gray and Kotcher 1947
		Southeast Quarter	1946	Rural	Commensal	6	298			
		Forrest County only	1946	Urban	Commensal	39	133			
		Jackson County only	1946	Urban	Commensal	0	93			
		Southwest Quarter	1946	Urban	Commensal	21	262			
		Southwest Quarter	1946	Rural	Commensal	15	149			
		Northern Half	1946	Urban	Commensal	6	209			
		Northern Half	1946	Rural	Commensal	0	142			
	Texas	Lavaca County	1945	Urban	Adult *R. rattus*	71	307	1:10	General survey	Irons, et al. 1948
			1945	Urban	Young *R. rattus*	43	165			
			1945	Rural	Adult *R. rattus*	48	367			
			1945	Rural	Young *R. rattus*	40	161			
		San Antonio	1945	Urban	Adult *R. rattus*	48	52	Not Stated	General survey	Davis 1948
			1945	Urban	Young *R. rattus*	12	49			
			1945	Urban	Adult *R. norvegicus*	66	88			
			1945	Urban	Young *R. norvegicus*	38	40			
Marginal	Texas	Brownfield Area	1946-47	Rural	*R. norvegicus*	19	191	1:10	General survey	Data by Miles, Wilcomb, and Irons.
			1948	Rural	*R. norvegicus*	14	263			
			1949	Rural	*R. norvegicus*	10	185			
	Kentucky	Bowling Green	1947	Urban	*R. norvegicus*	50	24	1:8	Restricted to probable foci	Hardin 1948
			1947	Urban	*R. norvegicus*	2	50		Away from probable foci	
		Louisville	1948	Urban	*R. norvegicus*	0.3	351	1:8	General	Good and Kotcher 1949
	Missouri	St. Louis	1947	Urban	*R. norvegicus*	0.9	904	1:8	General	Not Published
		Kansas City	1947	Urban	*R. norvegicus*	19	378	1:8	Restricted to probable foci	Buhler and Mueller 1948
	Kansas	Wichita	1947	Urban	*R. norvegicus*	5	99	1:8	General	Not Published
		Douglass	1947	Urban	*R. norvegicus*	67	6	1:8	One grain elevator	Not Published

*Includes both *R. rattus* and *R. norvegicus*.

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hence quite comparable in nature. Some, however, were selective, having been made in a few buildings, garbage dumps, or other selected places in which the level of typhus incidence would be quite atypical of the area in general. These reveal a spotty distribution in marginal areas.

In Baltimore, Md., evidence of murine typhus in rat fleas was found in 1930. Fleas taken in that city were found infective to laboratory animals (4). No great amount of transmission to humans occurs in Baltimore but cases occur frequently enough to indicate that murine typhus continues to exist in this marginal area.

In Louisville, Ky., (table 1) where a general rat typhus survey was made of the entire city and tests of rat serums were made by the complement fixation process, only 1 rat out of 351 (0.3 percent) appeared to have or to have had typhus (6). However, the titer here was low (1:8) so there may be doubt about the presence of murine typhus at the time of the survey. The number of Oriental rat fleas present indicates that typhus will flourish among domestic rats if introduced.

In St. Louis, Mo., only 0.9 percent of 904 Norway rat blood samples taken in a general survey in 1947 reacted positively. The titers were low, ranging from 1:8 in seven rats to 1:32 in one rat. Apparently this is strong enough evidence to indicate that murine typhus existed among the rats at the time of the survey.

In Kansas City, Mo., 378 rats were taken in a selective survey from 86 establishments, and infected rats were found in 16 percent of these 86 establishments. Nineteen percent of the 378 rats taken were positive (1). This survey was selective in that most of the rats were taken in premises in which human cases had been contracted or in surrounding buildings. The rate of typhus incidence was, therefore, higher than it would have been had the survey been more random and general. Typhus is nevertheless present and widespread in some sections of Kansas City.

In Wichita, Kans., 5 out of 99 rats (5 percent) taken in 1947 in a more random survey were found positive; 3 of these positive rats, however, were taken from the same building. The highest titer in one rat was 1:256. However, all rats showing titers greater than 1:8 were taken from the single building in which the three positives were found. At the nearby town of Douglass in Butler County, Kans., 4 out of 6 rats (67 percent) taken from a grain elevator were positive for typhus at titers of 1:8, 1:128, 1:256, and 1:512 respectively.

Unpublished data obtained in a cooperative State-Federal plague-typhus study in the Brownfield, Tex., area 1946–1949 show a high incidence of typhus antibodies in the rats of that area. In 1946–1947, 19 percent of 191 rats tested proved positive, and in 1948–1949, 12 percent of 448 rats showed the presence of typhus antibodies.

In southern California, where exists a small but rather uniformly favorable area for typhus among rats, positive reactions also were found. In the three southern coastal counties of San Diego, Orange, and Los Angeles, approximately 5 percent of 163 rat serums tested during the period 1948–1950 showed the presence of typhus antibodies. With the exception of two rat serums from Alameda County (Oakland and vicinity) which gave very low, inconclusive reactions, no serums positive for murine typhus were obtained from 286 other rats taken in various sections of the State (2).

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A METHOD FOR RAPID IDENTIFICATION OF MOSQUITOES FROM LIGHT TRAP COLLECTIONS

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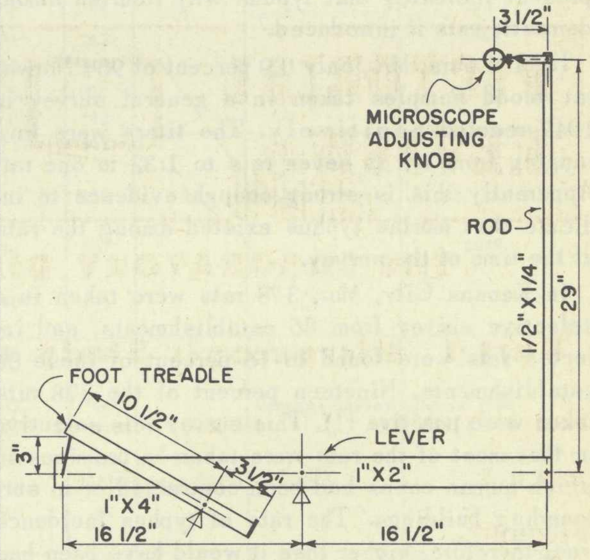
The method of rapid identification of mosquitoes from light trap collections, employs a foot-operated device for focusing a dissecting microscope and an especially constructed trough for holding mosquitoes within the field of vision on the microscope stage. By the use of these aids, the identification of large numbers of mosquito specimens is greatly expedited. Both hands remain free for manipulations on the microscope stage, and the eyes need not be shifted constantly between the oculars of the microscope and the specimens being identified. The focusing device also has been found useful in the preparation of mounts of larvae and of male terminalia, and for other items requiring a considerable amount of manipulation under magnification.

The foot-operated focusing device consists of a treadle assembly which rests on the floor and is connected by a lever and a rod to a clamp fastened around the focusing knob of the microscope. Figure 1 presents a diagram of the apparatus. Materials needed for construction are as follows:

Figure I

FOOT–OPERATED DEVICE FOR FOCUSING A DISSECTING MICROSCOPE



Treadle: wood, 1 by 4 inches, 14 inches long, with the fulcrum 10½ inches from the point of connection to the lever. A small cleat may be added to prevent the foot from slipping off the treadle.

Lever: wood, 1 by 2 inches, the flucrum 16½ inches from the connection to the treadle and 16½ inches from the connection to the rod.

Rod: wood, ½- by ¼-inch, 29 inches between connection with lever and clamp.

Clamp: metal, fashioned from an automobile radiator hose clamp, of sufficient length to permit attachment of the rod at a point 3½ inches from the center of the microscope adjusting knob.

Fulcrums of the treadle and lever are 8-penny common nails, fitting snugly into drilled holes.

Connector between the treadle and lever is of No. 12 iron wire, crank-shaped, the parallel sections being about 3 inches apart. One end fits snugly into a drilled hole in the lever and the other is held snugly to the treadle by staples.

The rod is connected to the lever and clamp by

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