

Vesicular Exanthema in the United States— Some Epidemiologic Aspects of the Disease

R. A. BANKOWSKI, D.V.M., Ph.D.

Having as we do this disease of pigs to thank for our recently won protective measure against human trichinosis, all of us will find an interest in this account of the past and recent history of vesicular exanthema.

✻ Vesicular exanthema (VE) belongs to a group of contagious and infectious diseases of domestic animals. These diseases are caused by filtrable viruses and are characterized by acute febrile reactions in the course of which vesicular eruptions develop on the buccal and associated mucous membranes and other selected epithelial sites. There are three important infections in this group, foot-and-mouth disease, vesicular stomatitis, and vesicular exanthema. These vesiculating diseases so closely resemble each other that a differential diagnosis is clinically impossible.

Vesicular exanthema made its first apparent appearance in the southern part of California in 1932 as a disease occurring in swine. At first this infection was believed to be foot-and-mouth disease, but Dr. J. Traum of the University of California who studied this infectious agent in laboratory animals regarded it as a specific infection which was caused by an ultravirus, but which was distinct from foot-and-mouth disease and vesicular stomatitis.¹ He reported that this agent affected only swine and failed to affect other species of animals. The original source of this

infection is still unknown. A further and an important observation made at this time was that the disease was found exclusively on ranches practicing the feeding of raw garbage to swine.

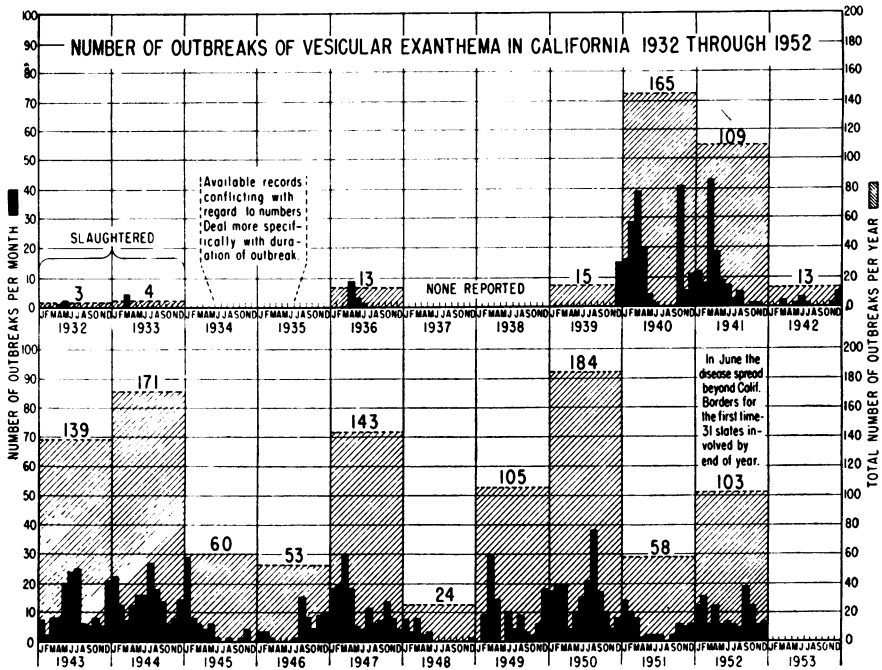
The incidence of vesicular exanthema in California from the first reported outbreak through 1952 is illustrated in Figure 1.² The first outbreaks, which occurred in the spring of 1932, were eradicated by the methods employed in a foot-and-mouth disease outbreak, consisting of the elimination of the swine by slaughter, cleaning and disinfection of the infected premises, pens, vehicles, and equipment, and thorough imposition of rigid quarantines. It was assumed, therefore, that no infective animal matter or material could have remained.³ Nevertheless, the disease reappeared 11 months later about 70 miles distant from the previous outbreak. The procedure adopted for eradication of this second outbreak was in all respects the same as in the first instance except that area quarantines and restrictions were not enforced. It

Dr. Bankowski is associate professor, School of Veterinary Medicine, University of California, Davis, Calif.

This paper was presented before a Joint Session of the Epidemiology and Laboratory Sections of the American Public Health Association at the Eighty-first Annual Meeting in New York, N. Y., November 10, 1953.

This project was supported in part by grants from the Public Health Service, National Institutes of Health, and the Agricultural Research Service, U. S. Department of Agriculture.

Figure 1



is still believed that no infected meat, meat scraps, or infected material could have remained to constitute a possible cause of the third outbreak which occurred 500 miles distant in the northern part of the state in June, 1934. As there was no contact or interchange of persons, animals, or equipment between these ranches, no satisfactory explanation can be given for the occurrence of the infections.

Just as suddenly as the disease was discovered, vesicular exanthema disappeared and was not recognized or reported for a period of three and one-half years. Then, during the winter months of 1939, an outbreak was reported on a garbage-feeding ranch in the northern part of the state. Hereafter, outbreaks steadily increased in numbers during the intervening 14 years and vesicular exanthema has today become one of the major swine disease problems in the state.

The erratic and unpredictable behavior of the disease noted during the early appearances seems to be characteristic of this infection. The incidence of vesicular exanthema does not appear to be seasonal or associated with precipitation. In June of 1952, as had been anticipated for many years, the disease appeared outside of the borders of the State of California for the first time and during the following six weeks was reported in 16 states.⁴ Efforts to stem the tide of this epizootic failed and within the next 13 months the disease was reported from 42 states and the District of Columbia.

Within an outbreak the disease is spread by the infected animals or by contaminated materials and objects, but there is considerable evidence that the practice of feeding raw garbage to hogs has been the chief means of perpetuating this disease in California. Of 20,000 swine-raising establishments,

about 400 practice feeding of raw garbage to swine. During the past 20 years we have had approximately 1,400 outbreaks of vesicular exanthema which were found predominantly on these garbage-feeding establishments. Only 53 outbreaks have been found on the 19,600 grain-feeding ranches, and in nearly all of these cases the outbreaks have been attributed to the exchange of hogs or having a history of feeding raw garbage. A careful study of most of these 53 outbreaks showed no incidence of recurrence of the infection on the ranch after the disease had run its course and the hogs had recovered. This evidence, substantiated by experimental proof that carcasses of infected animals contain virus,⁵ indicates that raw garbage containing meat scraps is one of the chief means of spreading VE in California.

Early epidemiologic studies of the inconsistent nature of the disease confirmed the existence of more than one immunologic type of the virus. Four immunologically distinct types were reported by Crawford,⁶ but unfortunately the original isolates are no longer available. However, current studies of outbreaks occurring in California resulted in the recovery of three distinct types: the latter were designated as types F, B, and A, but more recently have been reclassified as immunotypes A₄₈, B₅₁, and C₅₂, respectively, in conformity with the recommendations of the U. S. Bureau of Animal Industry. New immunologically distinct types are to be designated by the next letter and include the year of isolation in an effort to establish type standards.*

Since the three important vesiculating diseases, foot-and-mouth disease, vesicular stomatitis, and vesicular exanthema, so closely resemble each other, an accurate and rapid differentiation is of

Table 1—Susceptibility of Various Species of Animals to Viruses of Exanthematous Diseases

| Species | Foot-and-Mouth Disease | Vesicular Stomatitis | Vesicular Exanthema |
|-------------|------------------------|----------------------|---------------------|
| Horse | — | + | ± |
| Cattle | + | + | — |
| Swine | + | + | + |
| Sheep | + | ± * | — |
| Guinea pigs | + | + | ± † |

* Controversial among investigators

† Reported on rare occasions

extreme importance. A method which has been in use for a good many years is the animal inoculation test,⁷ carried out by inoculating a number of species of animals with the suspected material and the incriminating disease being produced in only those animals which are susceptible to the virus present in the material (Table 1). There are several points relative to this procedure that must be considered: (1) known susceptible animals are not always available in the vicinity of the outbreak; (2) from four to 10 days are required for symptoms to develop in susceptible hosts; and (3) at times it is extremely difficult to arrive at a definite conclusion following inoculation of one group of animals.

Recently, a complement-fixation test was introduced⁸ which has proved to be a great aid in making a rapid diagnosis and at the same time is capable of differentiating the virus into its immunologic type. Since the development of this test, 263 samples of infected material from hogs in the field have been submitted by veterinarians of the California Bureau of Livestock Disease Control to the laboratory for study.† Unfortunately, all samples submitted were not found to be usable, especially

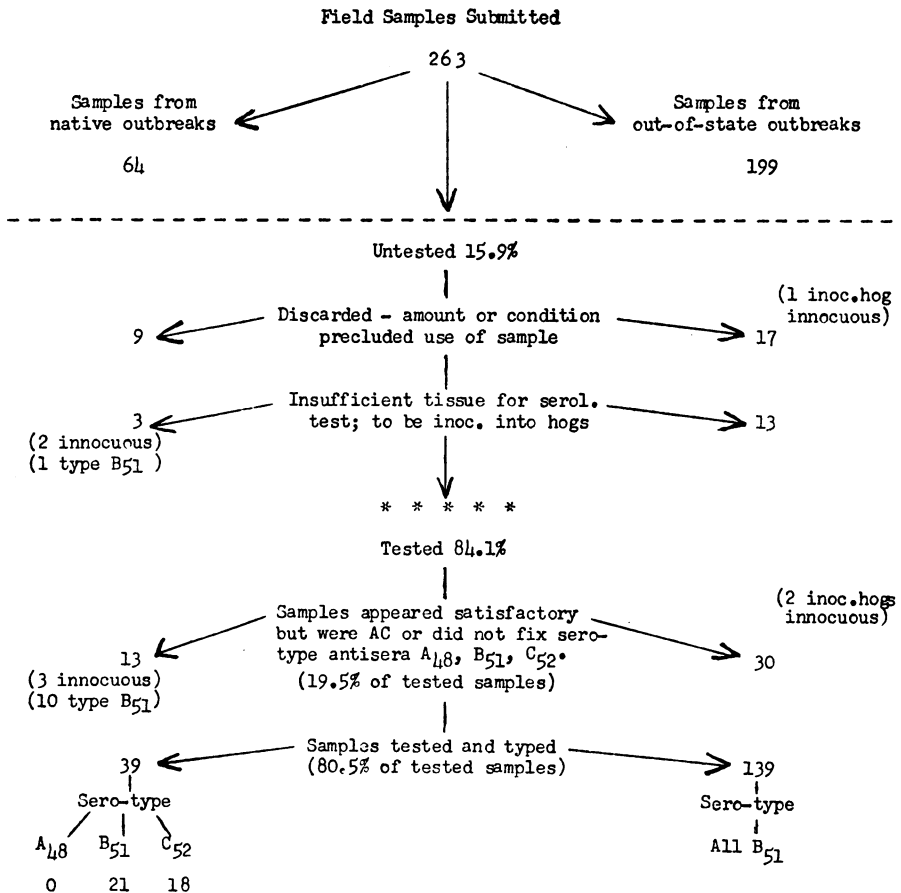
* The fourth immunologic type of VE virus was recovered and identified in an outbreak which occurred in October, 1953, in Riverside, Calif. The virus was designated as type Dss.⁹

† It is to be noted that no infectious material is sent to the laboratory prior to being inoculated and observed in calves by official veterinarians to exclude the possibility of transporting foot-and-mouth disease virus through public channels.

in the beginning of this program. Careful collection and handling of the samples appear to be a very important aspect of this procedure. In some cases (15.9 per cent) the material or amount of tissue collected was found to be decomposed or insufficient for the test (a minimum of 1 gm. is necessary). Other samples which were apparently collected in the late stages of the disease, or were improperly collected and stored, were found to be anticomplementary, or did not fix the antisera for Types A, B, or C VE virus. It is axiomatic that such samples, if they contain viable virus,

could be inoculated into susceptible hogs to produce a sufficient amount of tissue for the test; however, the advantage of speed in the diagnosis of a vesicular disease would be defeated. Figure 2 shows that of the samples which were suitable for testing 80.5 per cent could be successfully typed. It is interesting to observe from the results that both Types B and C were encountered in outbreaks occurring in garbage-feeding establishments in California, whereas without exception only Type B virus was found in diseased hogs that were shipped into the state from in-

Figure 2—Results of Serological Testing of Samples Obtained from Outbreaks of Vesicular Exanthema in California Between October, 1951, and June, 1953



ected areas. Type A virus was not detected in any of the samples tested; however, the 64 samples from native outbreaks were obtained from hogs raised on premises located predominantly in the north-central part of the state, whereas the original Type A virus was isolated in the southern part of the state.

A study of the history and incidence of vesicular exanthema as it occurs in California indicates that the disease has no seasonal predominance and is spread by contact with infected animals or products from infected animals that often are found in raw garbage. The complement-fixation test—which employs vesicular material harvested from infected hogs in the field—appears to be a great aid in the diagnosis and differentiation of this disease. From the serologic studies of a large number of outbreaks originating in various

states in the country it became evident that only one type (B) of VE virus escaped from California and it can be presumed that the epizootic involving most of the states resulted from a single incident.

REFERENCES

1. Traum, J. Vesicular Exanthema of Swine. *J. Am. Vet. M. A.* 88:316, 1936.
2. Compiled from records of the Bureau of Livestock Disease Control, Division of Animal Industry, California State Department of Agriculture.
3. Thirteenth Ann. Rep. California Department of Agriculture, 21, 12:444, 1931.
4. Special Report of the Joint Legislative Committee on Agriculture and Livestock Problems on Vesicular Exanthema. Sacramento, Calif.: Senate of the State of California (August 7), 1952.
5. Unpublished data.
6. Crawford, A. B. Experimental Vesicular Exanthema of Swine. *J. Am. Vet. M. A.* 90:380, 1937.
7. Traum, J. Foot and Mouth Disease: Specific Treatment, Eradication and Differential Diagnosis. *Proc. 12th Internat. Vet. Cong.* 2:87, 1934.
8. Bankowski, R. A.; Wichmann, R.; and Kummer, M. A Complement-Fixation Test for Identification and Differentiation of Immunological Types of Vesicular Exanthema in Swine. *Am. J. Vet. Res.* 14:145, 1953.
9. Bankowski, R. A.; Keith, H. B.; Stuart, E. E.; and Kummer, M. Recovery of the Fourth Immunological Type of Vesicular Exanthema Virus in California. *J. Am. Vet. M. A.* (In press.)

State Tuberculosis Programs

The Public Health Service has published "State Tuberculosis Control Programs." Included is selected information reported in the state public health plans submitted by state health departments for the fiscal years 1954 and 1955. Beginning in 1954 state health agencies had the choice of preparing a narrative description of the health agency's planned operation or the Annual Combined Report and Plan form. In 36 state narrative reports a description of the health needs and problems pertinent to tuberculosis control was included.

Hence, the present report reflects a variety of inadequacies and problems—shortage of personnel, shortage of hospital beds for tuberculosis, absence of local health departments, need for more intensive case finding, and extension of mass surveys are among the current problems indicated. The programs and plans are described state by state for each region of the Public Health Service. Public Health Service Bulletin No. 396, Public Health Service, Washington 25, D.C. Apparently free.