Size of a Granulosis Virus of Pieris rapae (L.)

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A granulosis virus, Bergoldia virulenta Tanada, which attacks the imported cabbageworm, Pieris rapae (L.), was described in 1953 (Tanada, 1953). Smith and Xeros (1954) in their review of this paper remarked: "Tanada states that there was a great variation in the width of the virus rods (40–100 mμ). It is clear from the published pictures, however, that this huge variation is not entirely due to variations in the width of the virus rods themselves, but that the virus particles are about 40 mμ wide, and those bodies taken as very wide rods by Tanada are virus rods still surrounded by their inner capsules, and having a diameter of about 90 mμ."

It should be pointed out that Smith and Xeros extracted the above measurements of the virus rods or particles out of context and did not quote the final measurements given in my paper. They also failed to mention that an adequate explanation, similar to theirs, was given for the great variations in the size of the virus particles as indicated by the following quotation from my paper (p. 242): "In 286 particles examined, the width ranged from 41 to 100 millimicrons, while the length ranged from 221 to 290 millimicrons. Most of the virus particles ranged within 61 to 90 millimicrons by 231 to 270 millimicrons. Apparently these fairly thick virus rods were enclosed in a membrane which has been called the 'spherical membrane' by Bergold (1950)." Thus, the greater thickness of the broad rods was attributed to the spherical membrane, which Smith and Xeros designated as "inner capsule."

In the next paragraph, I mentioned the presence of distinctly thinner virus particles, and an electron micrograph showing these thin particles was presented (fig. 3C, p. 243). Again, quoting from my paper: "... the virus particles were not only distinctly thinner, but some of the particles had the spherical membranes attached to them (Fig. 3C). Occasionally what appeared to be empty collapsed membranes could be seen. The size of these naked particles ranged from 31 to 60 millimicrons in width and 191 to 340 millimicrons in length, with most of them being 41 to 50 millimicrons by 291 to 300 millimicrons." In the summary, the measurement of the free virus particles was given only as 41 to 50 millimicrons by 291 to 300 millimicrons. Thus, the variation in width both with and without the spherical membrane of 41 to 100 millimicrons was given just once in the paper, the presence of
the membranes on the broad particles was reported, and the range of 41 to 50 millimicrons was given as the actual width for the free virus particles. Bergold (1953) correctly quoted the measurement of 41–50 x 291–300 millimicrons from my paper.

Most authors present the size of virus particles as an approximate average. It is obvious that exact figures could not be given for the size of virus particles because of: (i) inherent variations in the size of the virus particles, (ii) some variations in the size of the polystyrene particles used as a standard, (iii) errors in measurements, (iv) errors inherent in the electron microscope, and (v) distortions which arise during the preparation of the virus particles for electron microscopy. With these possible sources of error in mind, I had decided to represent the size of the virus particles within a range of 10 millimicrons which included the mean. Possibly, it would have been better still to have presented the mean and its standard error.

From my original measurement of the 191 naked virus particles, I have now calculated their average width and length. The mean width was 46.9 millimicrons with a standard error of ±7.5 millimicrons, and the mean length was 293.6 millimicrons with a standard error of ±23.7 millimicrons. When enclosed in the spherical membrane (inner capsule), the mean width of 286 virus particles was 75.1 millimicrons with a standard error of ±6.7 millimicrons, and the mean length was 248.1 millimicrons with a standard error of ±11.6 millimicrons. As I had explained in my paper, the virus particle when enclosed within the spherical membrane is usually slightly curved and therefore appears shorter than the free particle. Bergold (1953) has also isolated the naked virus particles of *B. virulenta* and his measurements were 42 x 268 millimicrons.

References

