

## OCCURRENCE OF THE ISOPOD IRIDOVIRUS IN EUROPEAN *ARMADILLIDIUM* AND *PORCELLIO* (CRUSTACEA, ISOPODA)

by

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### ABSTRACT

First record of iridovirus infections of terrestrial isopods (*Armadillidium vulgare* and *Porcellio scaber*) in Europe (The Netherlands). Infested specimens can be detected by their bright blue color.

### RÉSUMÉ

L'infection d'Isopodes terrestres (*Armadillidium vulgare* et *Porcellio scaber*) par un iridovirus est signalée pour la première fois en Europe (Pays-Bas). Les spécimens infectés sont facilement reconnaissables à leur couleur bleu-vif.

### INTRODUCTION

The first report of iridoviruses infecting terrestrial isopods of the genera *Porcellio* and *Armadillidium* appeared in 1980 (Cole & Morris, 1980; Federici, 1980) and the subject was reviewed by Hess & Poinar (1985). These reports referred to individuals of *A. vulgare* and *P. scaber*, two species considered native to the Palearctic region which were introduced into North America. Finding these species infected with iridoviruses in California was curious because no record of this association had been previously reported in Europe. The present report confirms the presence of the isopod iridovirus in Dutch populations of *P. scaber* and *A. vulgare* and documents the first records of this infection in Europe. Infected isopods can be detected from their bright blue color, in contrast to the grey color of non-infected individuals.

### MATERIALS AND METHODS

Infected specimens of *Armadillidium vulgare* (Latreille, 1804) and *Porcellio scaber* Latreille, 1804 were collected from a covered, shallow well in the village of Zandvoort (province of North-Holland) in The Netherlands. The site was located in the dune area, approximately 100 m from the sea. Infected individuals were also noted in neighboring gardens.

Some additional infected specimens of *A. vulgare*, now preserved in the Zoölogisch Museum, Amsterdam, were collected late 1984 in a garden in De Lairesestr., in the center of Amsterdam.

The isopods were stored frozen at  $-70^{\circ}\text{C}$  until ready for examination. Frozen specimens were ground individually in extraction buffer (0.01 M Tris, 0.001 M EDTA, 0.1 % Mercaptoethanol) and centrifuged for 1 minute in a Beckman Microfuge B. The supernatant was mixed in equal amounts with uniform latex particles (91 nm, S.D. = 2.7 nm) diluted 1 : 1 with 0.1 % Bovine serum albumin and applied to 200 mesh grids for electron microscope observations. Grids were stained with saturated aqueous uranyl acetate and examined at 60 KV on a Philips EM 300 electron microscope. Specimens of *Armadillidium vulgare* isolated from the California population and known to be infected with the isopod iridescent virus were similarly processed as a standard.

Some supernatant was mixed in equal amounts with Afrin, a nasal decongestant, and treated in a manner similar to that applied by Wrigley (1969) on *Sericesthis* iridescent virus (SIV).

### RESULTS

Virus particles were observed in both *A. vulgare* and *P. scaber* collected from Holland. The particles were identical in morphology and size to the isopod iridescent virus isolated from

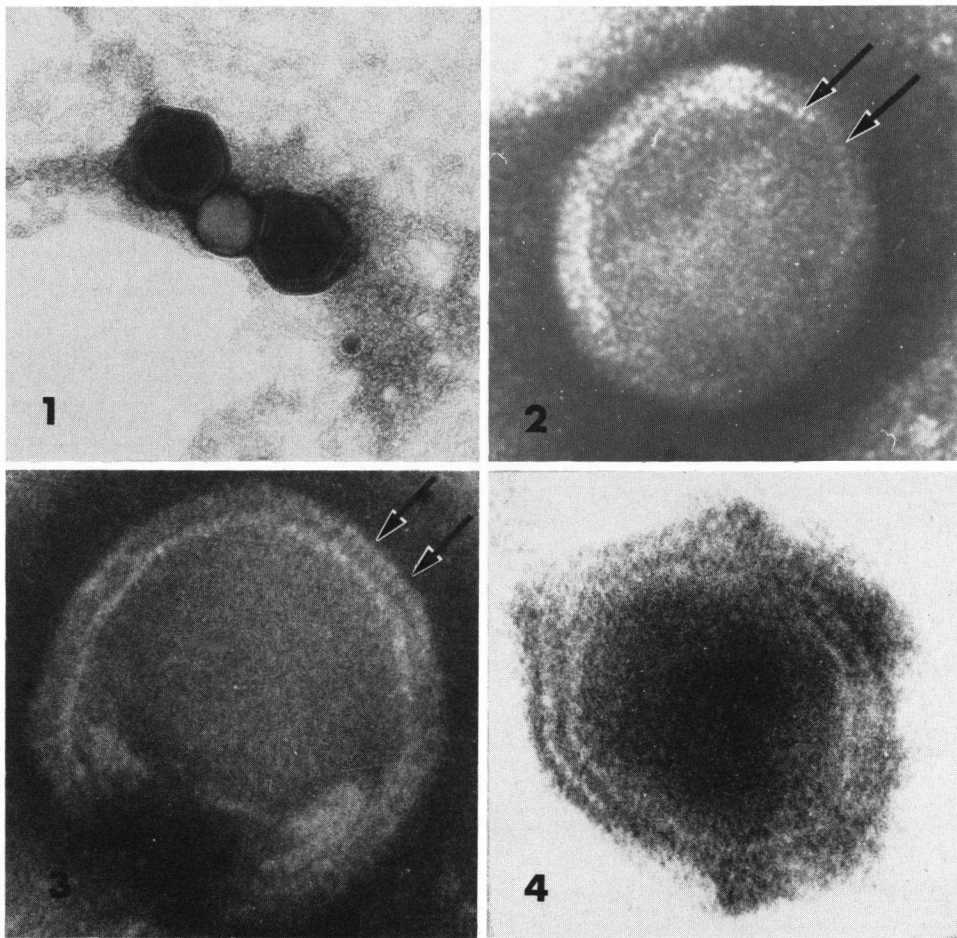


Fig. 1. The isopod iridescent virus from Dutch *A. vulgare* in a mixed suspension with uniform latex particles  $91 \text{ nm} \pm 2.7 \text{ nm}$  in diameter is shown. The hexagonal morphology of the virus is evident.

Fig. 2. The isopod iridescent virus from Dutch *P. scaber* which has been treated with Afrin, a nasal decongestant, is apparently covered with globular capsomers approximately  $5 \text{ nm}$  in diameter (arrows).

Fig. 3. In negatively-stained virus the outer layer or shell is seen to have a striated substructure composed of units approximately  $5 \text{ nm}$  wide (arrows). The inner membrane-like layer surrounds the dense core.

Fig. 4. Positively-stained particles illustrate the outer shell and the inner membrane-like layer surrounding a dense core.

California specimens of *A. vulgare*. The virus was hexagonal in outline and averaged  $139 \text{ nm}$  in diameter ( $137\text{-}142$ ) when uniform latex particles ( $91 \text{ nm} \pm 2.7 \text{ nm}$ ) were used as a standard (fig. 1). Afrin-treated particles revealed the presence of globular capsomers approximately  $5 \text{ nm}$  in diameter on the outer surface of the virus (arrows, fig. 2). In suspensions of virus not treated with Afrin this outer surface or shell could be seen as a regularly-spaced striated structure (arrows, fig. 3). Both negatively- (fig.

3) and positively-stained (fig. 4) virus particles revealed the presence of an outer rigid shell and an inner membrane-like structure surrounding a dense core or nucleoid.

The arrangement of the virus particles in the tissues produces an iridescence which is easily seen through the cuticle and turns the infected individuals a characteristic blue-purple color. Upon dissection, iridescence can also be observed in the epidermal, muscle and adipose tissues.

## DISCUSSION

The discovery of iridovirus-infected *A. vulgare* and *P. scaber* in North America raised the question of whether the infection might naturally occur in Europe as well.

A literature search revealed that, while reports of iridovirus-infected isopods are lacking outside of California, reports of blue terrestrial isopods do exist. In many cases, these blue individuals were assigned separate taxonomic ranks (usually new varieties) on the basis of their color. Thus Lereboullet (1843) described blue individuals of *Ligidium hypnorum* (Cuvier, 1792) as the new variety, *coeruleum*, in France. Other blue individuals of *L. hypnorum* were named variety *amethystinum* by Schöbl (1861) in Czechoslovakia. Other blue or purple varieties of terrestrial isopods were reported in France (Vandel, 1962), England (Norman & Brady, 1911) and Turkey (Ermin, 1943).

The iridoviruses isolated from Dutch isopods are very similar to those isolated from Californian specimens and the present report demonstrates that the infection distribution is holarctic.

The present report and earlier studies on the isopod iridovirus in North America indicates that blue isopods occurring among populations of normally dark-colored species are probably infected with iridoviruses, especially if iridescence is associated with the tissues. This implies that the occurrence of the virus extends from northern Europe (England, Holland) into Asia (Turkey).

It would be interesting to examine the blue-violet variety *meleagris* of the European isopod *Metoponorthus pruinosus* (Brandt, 1833) since this hue is apparently a normal condition (Vandel, 1962). Either the blue color is due to another cause, or the infected individuals can tolerate the infection rather well and succumb only after

their reproductive cycle has finished. Federici (1980) noted that healthy specimens of *A. vulgare* and *P. dilatatus* survived 3 and 6 times longer, respectively, than did iridovirus-infected members of the population. The factors affecting mortality under natural conditions have yet to be defined. Cole & Morris (1980) noted that with field-collected *A. vulgare* and *P. scaber*, all those infected with the iridovirus died 1-2 weeks after being brought into the laboratory whereas the healthy individuals survived for 6 months under laboratory conditions. It is possible that infected individuals succumb sooner when placed under artificial conditions. Biological observations on European infected individuals have yet to be made.

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