USE OF SPECIFICITY DIFFERENCE INDICES FOR THE IDENTIFICATION OF NUCLEAR POLYHEDROSIS VIRUSES (BACULOVIRUS) OF INSECTS

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The specificity difference indices (SDI) are a quantitative comparison of the degree of virulence shown by 2 viruses when assayed on 2 species of insect hosts. The establishment of these indices permits the choice of better strains for the development of preparations for use in the control of crop or forestry pests with viruses.

We have demonstrated a specificity difference index which is relatively high for 2 viruses of different origins but which are indistinguishable by serology. The SDI thus can be used as a supplementary method for the identification of virus samples particularly those useful in mass culturing and biological control. In this area, the identification of the viruses is very important and bioassays, necessary for the establishment of the SDI, are already an ongoing activity for other purposes.

It was again shown that the viruses isolated from other species have a lower virulence than those isolated from the homologous insect species.

The diagnosis of diseases and identification of pathogens are very important factors for the research on the microbial control of insects.

The standardisation of preparations begins with a precise identification of the pathogen. This is illustrated by the case of Bacillus thuringiensis. A precise diagnosis is important as stressed by the objective of the recent symposium of the "Commission de Pathologie des Insectes et de Lutte Microbiologique" of the O.I.L.B./S.R.O.P., on 21-22 March 1975 at St Christol les Ales, France. The subject of the symposium was "Methods in diagnosis of insects diseases in view of their utilisation in microbial control".

In the case of nuclear polyhedrosis (Baculovirus), the inclusion bodies are easily recognised using the light microscope. The identification of different samples, however, requires more complex methods, as for example, histology, histochemistry, serology, electron microscopy and tissue culture, taking into consideration their advantages and limitations.

For a virus which is highly specific, the designation of the original host or the result of a bioassay may be sufficient for using it in biological control and for unequivocal characterisation and identification. However, some nuclear polyhedrosis viruses attack several hosts and alternatively the same host can be affected by different viruses. The identification of virus samples has thus become a current preoccupation in the work on microbiological control.

If the spectrum of biological activity proves to be a stable characteristic of the different viruses (which would, in fact, be desirable and necessary for biological control), the determination of activity spectra of Baculovirus would be an important diagnostic
tool to be used together with other diagnostic procedures. This is shown by the example presented in this paper where 2 serologically and morphologically indistinguishable Baculovirus are differentiated by their activity spectra, based on the Specificity Difference Indices (SDI) which were previously defined (BURGERJON et al., 1975).

MATERIALS AND METHODS

Two samples of Baculovirus have been examined: one of American origin (Dr VAIL) isolated from Autographa californica SPEYER and the other of Russian origin (Dr GERSHENSON) isolated from Galleria mellonella L. Despite the great difference in geographical and biological origin of these viruses, CROIZIER & MEYNADIER (1975) were not able to distinguish them by serological analysis, even though this method gives positive results for the characterisation of other Baculovirus. Both these viruses possess cubic polyhedra (VAIL et al., 1970; GERSHENSON, 1957; VAGO et al., 1970) which is rare for this class of viruses. VAIL et al. (1970) and GERSHENSON (1957) have demonstrated that the 2 viruses are virulent for several Lepidoptera, such as: Spodoptera exigua HB., Trichoplusia ni HB. (Noctuidae), Plutella maculipennis CURT. (Plutellidae), Estigmene acrea DRURY (Arctiidae), Bucculatrix thurberiella BUSCK L. (Lyrietiidae) for the virus from Autographa californica and Vanessa urticae L. (Nymphalidae), Pyrameis cardui L. (Nymphalidae), Achoria grisella F. (Pyralidae) for the virus from Galleria mellonella.

We have tested the virus sample from Galleria mellonella (GM) as an aqueous suspension of purified polyhedra described by CROIZIER & MEYNADIER (1975) and used for their serological analysis. The virus sample from Autographa californica (ACSE) was tested as a powder as previously used by BURGERJON et al. (1975). Another preparation of nuclear polyhedrosis virus from Mamestra brassicae L. (M.B.) was used for comparison. This virus however can be distinguished from the two others by serological analysis (CROIZIER & MEYNADIER, 1975).

The bioassays were carried out with newly hatched caterpillars fed during the 1st larval instar on a simple artificial medium described by POITOUT & BUES (1970). A plastic dish (41 mm diam. and 11 mm high) contained 2ml medium. The diet was inoculated in a treatment tower apparatus (BURGERJON, 1956) so that the fine layer of 1,5 mm medium was evenly sprayed with the suspension of polyhedra. Spraying of 10 ml in the treatment apparatus results in a deposition of 0,005 ml of suspension per cm² of medium. The doses shown along the abcissa of the graphs are expressed as number of polyhedra per mm² of medium. The following species of Lepidoptera were examined: Mamestra brassicae, Spodoptera exigua (Noctuidae), Chilo suppressalis Wlk. (Pyralidae) and Plutella maculipennis (Tineidae).

For P. maculipennis discs 12 cm² of cabbage leaf were sprayed instead of the artificial medium. The number of caterpillars used per dose were 50 for P. maculipennis, 40 for C. suppressalis, 50 for S. exigua and 90 for the tests with M. brassicae.

RESULTS

Two preliminary bioassays carried out on P. maculipennis and C. suppressalis indicated that the GM preparation was more infectious than the ACSE preparation (table 1), but there was no tendency towards a specificity difference. A bioassay using the same preparations plus the MB preparation carried out with three doses on S. exigua (fig. 1) demonstrated the superiority of GM over ACSE, whereas MB is inferior to both.