Differentiation of F38 Mycoplasmas Causing Contagious Caprine Pleuropneumonia with a Growth-Inhibiting Monoclonal Antibody

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Monoclonal antibody WM-25 inhibited the in vitro growth of 13 F38 isolates from goats with contagious caprine pleuropneumonia but not 7 heterologous mycoplasma isolates representing four different species. In contrast to results with polyclonal antisera, growth inhibition by monoclonal antibody WM-25 was specific for F38 mycoplasma isolates and constituted a reliable means of distinguishing F38 from other mycoplasmas.

Contagious caprine pleuropneumonia (CCPP) is a disease of major economic importance in Asia and Africa, posing a major constraint to goat production because of high mortalities. The disease occurs in 33 countries; 8 others are on a suspect list (2). Mycoplasma F38, isolated from a goat with pleuropneumonia in Kenya (16), produces classical CCPP, which includes transmission by contact, high mortality, and a fibrinous pleuropneumonia characterized by massive hepatization and pleurisy. Similar mycoplasmas are isolated from goats in Sudan (11) and Yemen (J. K. Bari, M.S. thesis, Washington State University, Pullman, 1984). There is a need to establish which F38 causes the CCPP reported in other countries (2).

Initial studies of F38 from Kenya suggested it might represent a new mycoplasma species (7). Also, electrophoretic analysis showed that F38 had isoenzyme patterns distinct from those of other mycoplasmas (22). However, in serological tests, F38 cross-reacts with several already established mycoplasma species (6-8, 13, 14). Further work using DNA hybridization (3) and two-dimensional electrophoresis of cell proteins (1, 19) did not clearly distinguish F38 from other mycoplasmas isolated from goats. Growth inhibition (4) and indirect epimunofluorescence (5) assays are considered species specific and are used to classify mycoplasma isolates (9). In these later tests, F38 cross-reacts with two other mycoplasmas which do not cause CCPP, bovine serogroup 7 and Mycoplasma capricolum (14, 15). This communication describes a monoclonal antibody which differentiates F38 by growth inhibition from other mycoplasmas.

To make monoclonal antibodies to F38, five BALB/c mice were injected intraperitoneally with 0.2 ml of a homogenized mixture of F38 organisms (0.2 mg of protein) and Freund complete adjuvant. The mice received two additional injections, 2 weeks apart, except with Freund incomplete adjuvant. The mice sera were tested for antibody activity against F38 antigen by an indirect enzyme-linked immunosorbent assay (ELISA) (20). Micro-ELISA plates with flat-bottom wells (Immulon, Dynatech-Deutschland Ambt, 7310 Plochingen, Federal Republic of Germany) were coated with 100 µl containing 100 µg of F38 protein suspended in 0.1 M carbonate buffer, pH 9.0, with 0.0025% glutaraldehyde, at 37°C for 18 h. Plates were washed three times with 0.01 M phosphate-buffered saline, pH 7.2, containing 0.1% Tween 20. Culture supernatants (200 µl) were added to the coated wells in duplicate, incubated at 37°C for 1 h, and washed three times. Antibodies to mouse serum conjugated to horse-radish peroxidase were added, reacted at 37°C for 1 h, and the plates were washed. Substrate, 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid)-diammonium salt (100 µl), was added for 30 min at room temperature and in the dark. The color change was read at 405 nm by a micro-ELISA reader. The mouse with the highest titer of antibody was inoculated intravenously with F38 antigen. Four days later, the mouse was killed and spleen cells were prepared for fusion (18). Briefly, Sp2/O myeloma cells in logarithmic growth were fused with the spleen cells in the presence of 50% polyethylene glycol 1500. Specific antibodies were detected in culture supernatants by ELISA, and those found positive were tested for F38 growth-inhibiting activity (4). Cells producing a growth-inhibiting antibody were cloned twice by limiting dilution, and the isolate was determined by immunodiffusion against rabbit antisera to mouse immunoglobulin isotopes (Litton Bionetics, Kensington, Md.).

Monoclonal antibody WM-25, an immunoglobulin M which caused growth inhibition of F38, was isolated by gel filtration (21) from the ascitic fluid of pristane-primed BALB/c mice given cloned WM-25-producing cells intraperitoneally. Fifty microliters of the isolated WM-25 (2.2 mg/ml) was tested for growth inhibition of 13 mycoplasmas isolated from goats dying of CCPP (10) and identified as F38 by growth inhibition with a polyclonal antisera to F38 (Table 1). The F38 isolates included prototype F38 (16), G92/81, G121/83, G152-4/83, G175/85, G183/82, G146/83, G94/83, G275/82, 232/82, G141/84, A/Narok/81, 2584, and G109/83. All these isolates were from different areas of Kenya except for G109/83, which was isolated from a goat lung from the Yemen Republic. All 13 isolates were inhibited by WM-25 but not by an unrelated immunoglobulin M control monoclonal antibody (TPM-12). In contrast, WM-25 did not inhibit growth of seven other mycoplasmas tested, even at mycoplasma concentrations 105 to 106 less than the concentration used for F38 isolates (Table 1). Included were two mycoplasma species previously shown to cross-react with F38, namely M. capricolum (3) and bovine serogroup 7 (14). Polyclonal antiserum to each of the seven mycoplasmas caused growth inhibition of the homologous mycoplasma.

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TABLE 1. Growth inhibition of F38 and other mycoplasmas with monoclonal and polyclonal antibodies to F38

<table>
<thead>
<tr>
<th>Mycoplasma</th>
<th>Range of CFU/ml</th>
<th>No. of isolates with growth inhibition/no. tested</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monoclonal antibody</td>
<td>Control monoclonal antibody</td>
</tr>
<tr>
<td></td>
<td>WM-25</td>
<td>TPM-12</td>
</tr>
<tr>
<td>F38</td>
<td>$1.3 \times 10^3$</td>
<td>13/13</td>
</tr>
<tr>
<td>Non-F38</td>
<td>$0.3 \times 10^3$</td>
<td>0/7</td>
</tr>
</tbody>
</table>

* The non-F38 mycoplasmas were M. mycoides subsp. mycoides Blenheim (small colony) and Y-goat (large colony); M. mycoides subsp. capri Smith 1423, M. capricolum (NCTC 10154), M. equi-gentialium (NCTC 10176), M. primatum (NCTC 1163), and bovine serogroup 7 (NCTC 10133). The growth of these mycoplasmas was inhibited by the homologous antiserum. The source and classification of these mycoplasmas was described previously (12).

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LITERATURE CITED