Virus Diseases and Crop Biosecurity

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Virus Diseases and Crop Biosecurity

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PREFACE

Biosecurity roughly means "safe life" and involves a variety of measures designed to prevent disease – causing agents from entering a region and there being spread.

Food supplies are easy to disrupt and the provision of biosecurity at land-land borders is especially challenging if trade is to be maintained and when very few travellers are subjected to thorough inspection.

Within the context of the NATO sponsored workshop that was held in Kiev, Ukraine during May 4–7, 2005, the pathogens were viruses that infect plants and the region encompassed developing states on the verge of acceding into the European Union. In publishing the papers presented at the workshop, we take this opportunity to thank the sponsors including particularly the NATO Science committee and also the contributors for making the discussions entertaining and beneficial.

Under United Nations FAO auspices, the International Plant Protection Convention aimed to secure common and effective activities against pests and pathogens. Now, most countries party to that convention have laws and regulations in place to sustain agricultural production under natural threat. National plant protection services exist to inspect growing crops and importations and to determine when and how introduced pathogens might be eradicated. The member states of the European Union, through their national [and also the regional plant protection service (The European and Mediterranean Plant Protection Organisation)], advise national governments and develops specific protocols (identification, containment and eradication) that aim at managing pests and pathogens in ways that have minimal impact on trade. The processes are costly and inconvenient. Furthermore, success is not certain. For these and other reasons, the efficiency of established phytosanitary systems are eroding and those who contributed at the workshop highlighted deficiencies that are now in urgent need of remedy.

The savage action in New York and Washington in September 2001 and the instances of anthrax delivery via the U.S. mail caused all types of potentially offensive activity to be assessed or reassessed. Human pathogenic viruses and micro organisms had been identified as of concern whether natural or modified/selected for enhanced virulence and pathogenicity. In some nation states, export controls now exist for a range of vertebrate pathogens. Furthermore, pathogens harmful to bees or the environment more generally are all objects of national or international regulation. However, no similar list of specific plant pathogens is yet internationally agreed despite the potentially

very significant long-term economic impacts coupled with psychological and social disruption.

With a few notable exceptions (e.g. use of a chemical toxin in Japan in support of racial/ethnic/religious and political objectives), non-military human targets seems to have been very uncommon. Furthermore, major terrorist groups have used "traditional" high explosives to obtain publicity and to engender fear in communities that they seek to influence. This does not provide reasonable grounds for complacency. Biological attacks on food supplies, forests or natural vegetation have long been envisaged and must now be considered "likely". Individuals and groups with regional political constituencies are now competent to use a diverse range of pests and pathogens to support their objectives. Living, self-replicating agents, notably viruses and micro organisms with lethal or debilitating outcomes, have been stockpiled and it is generally acknowledged that state-sponsored programmes have "weaponised" fungi (e.g. *Puccinia graminis*) active against plants grown for food. Additionally, *Sugar beet necrotic yellow vein virus* and *Plum pox virus* have been highlighted as candidate agents for use as weapons. Current technology can modify viruses to enhance what nature has already selected. Furthermore, although natural processes tend to result in a balance that moderates the impact of a pathogen in the interests of its persistence, that phenomenon has little relevance when the targets are agricultural crops and not natural self-regenerating populations.

Against this background, it is necessary to raise awareness in the global scientific community without causing undue concern in the lay community. To strengthen the position of scientists (and workers more generally), many nation states impose "health and safety" regulations that cover diverse chemicals and biological agents in line with national laws and also international treaty obligations. Two Conventions under the aegis of United Nations agencies are significant in this regard. The Convention on Biological Diversity was initially signed by 150 government leaders at the 1992 Rio Earth Summit and provides a framework for action bearing on sustainable development and trade. Support for those very broad ranging activities is not universal but has increased somewhat and currently the Convention has188 Parties (168 Signatures). In 2000, the Conference of the Parties to the Convention on Biological Diversity adopted a supplementary agreement known as the Cartagena Protocol on Biosafety. This protocol has a key role to play in matters of biosafety because it seeks to protect biological diversity from potential harm resulting from modern biotechnology (including risks posed by living (genetically) modified organisms). The Protocol enables the establishment of a pool of experts to facilitate the exchange of information. At present, the Cartagena Protocol on Biosafety has 130 Parties (103 Signatures) – but, once again, not all states are formally Party. It is notable that although the United States of America signed

the Biodiversity Convention, that country is neither Party to the Convention nor to the Biosafety Protocol!

Similarly, not all, nation states are party to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction [the Biological and Toxin Weapons Convention (BTWC) for short]. The BTWC broadened the terms of an existing Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare that had been signed at Geneva on June 17, 1925 and was signed at London, Moscow and Washington in 1972. It has laudable aims and facilitates international contacts but offers considerable scope for "interpretation". Thus, for the sake of mankind, the signatory states sought to exclude the possibility of bacteriological (biological) agents and toxins being used as weapons and undertook never to develop, produce, stockpile or otherwise acquire or retain microbial or other biological agents, or toxins in quantities that have no justification for prophylactic, protective or other peaceful purposes – or means of delivery designed to use such agents or toxins. Importantly, each state party to the BTWC agreed not to transfer any of these objects to any other state and to consult one another and to destroy all agents, toxins and means of their delivery while safeguarding the environment. Nevertheless, states party to the BTWC retained rights to participate in the fullest possible exchange of equipment, materials and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes.

Not all signatories have enacted appropriate national legislation or operate the same degree of health and safety regulation supported by inspection. There is a constant but slow progression in activities to further the aims of these two conventions and this activity is particularly obvious in the context of genetically modified organisms. Thus, the members of the European Union have agreed regulations (e.g. Directive 2001/18/EC) that require member states, in accordance with the precautionary principle, to ensure that all appropriate measures are taken to avoid adverse effects on human health and the environment (including agricultural production) which might arise from the deliberate releases of genetically modified organisms. Increasing the number and variety of codes of conduct provides important opportunities for education and training of workers including scientists and students in a variety of possible consequences. Undergraduate and postgraduate education programmes (in academic and also industrial settings) can be followed in a climate that supports consideration of ethical issues and helps to identify opportunities for possible misuse of technologies that may be mainly studied because they were expected to offer real potential benefits to society. Scientific research inevitably gives rise to some unexpected findings and the full potential implications are not always appreciated by workers in small intellectually isolates

teams. Fortunately, peer review prior to the funding of research, at later stages in the development of a programme and subsequently during the publication process all provide opportunities for broader appreciation of issues that bear on novelty. There is a clear need for improved guidance to improve the effectiveness of scientific oversight but it is still not easy to identify all issues pertinent to potential uses of knowledge. To this end national academies of science and publishers all have potential roles to play in the process and useful sources are open for inspection (e.g. www.journals.asm.org/misc/Pathogens and Toxins.shtml.; www.brad.ac.uk/acad/sbtwc/briefing/BP 15 2nd series.pdf.; www.sgm.ac.uk/pubs/policy.cfm).

Notwithstanding current obligations under one or other of the conventions, there are concerns that some nation states may be deliberately using students and scientists in training to procure expertise. Furthermore, it is now very easy for molecular geneticists to access scientific literature that describes which genetic sequences have potential utility, can be synthesised and then used to enhance pathogenicity. This scenario is not new but curtailment of information flow (and people) touches on sensitive areas of civil rights and traditional academic freedoms. The best protection against proliferation of biological agents probably is transparency, but covert research in this context is suspected to be not uncommon. Partly as a consequence, the potential hazard to agriculture from biological agents is underrated and is allocated less research support than issues directly bearing on human health. In discussion, many issues were explored that are not reflected in this volume. Contributors were anxious to avoid producing "a terrorist's handbook"!

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