Letters

Canadian "Yellow Rain" Research: Does It Weaken the Case?

Recently reported analyses of samples collected from toxic agent attack victims and sites have been narrowly interpreted in the popular and scientific press (News & Comment, 4 July, p. 18) (*1, 2*) as weakening the U.S. government's case with regard to the use of toxic agents for hostile purposes in Southeast Asia and Afghanistan.

From the beginning, the United States has charged that lethal and incapacitating chemical agents *as well as* toxins have been used for hostile purposes in Laos, Kampuchea, and Afghanistan (*3, 4*). We have based this judgment on data from all sources. The United States has encouraged other countries to investigate the circumstances surrounding the use of chemical and biological warfare agents in these areas.

As far as we are able to determine, recently cited Canadian research (*2*) represents continued responsible, objective analysis of the use of toxic agents (*5–7*). Although unconfirmed, the analysis was thorough, the detection method sensitive, and the redundant analysis performed on the unexpected positive samples adequate. The primary objective of the research was to investigate procedures for collection, transport, and analysis of biomedical samples. The research clearly demonstrates the need for the use of highly sensitive detection methods and proper sample handling. However, it neither proves nor disproves the natural origin of toxins; nor would finding toxins in noncombat regions argue against their exploitation for hostile purposes elsewhere. Furthermore, the high concentrations and unusual combinations of the mycotoxins found in blood, urine, and tissue of victims (*8*) and other samples from attack sites (*9*) have not been observed in noncombat samples. The Canadian research contributes to the baseline data for further investigations, which we welcome.

With regard to the 1982 Canadian analysis (*6*), it has been argued that the levels of trichothecene mycotoxins are near those found to occur naturally and that the data would "appear to support . . . a natural explanation for the toxins" (*2*). More significant than the exact quantities of mycotoxins found are the Canadian conclusions, especially when taken together with those in previously reported analyses. In their epidemiological investigations, Humphreys and Dow (*5*) observed symptoms consistent with mycotoxicosis. In one case, the Canadians were able to revisit the attack site for collection of samples, and those samples were analyzed and reported (*6*). Trichothecene mycotoxins "were identified unequivocally" (*6*, p. 10) in those samples. The piece of the plastic bag hypothesized to be part of a delivery system "contained much higher levels of trichothecenes" (*6*, p. 19). The Canadian analysis is compelling by itself, but the use of mycotoxins for hostile purposes is even more strongly substantiated: the United States received and analyzed vegetation contaminated in the same attack and found significant quantities of the mycotoxins T2 and diacetoxyscirpenol (*4*).

The Canadian study (*6*) provides a critical link in a now-complete attack scenario: observation by victims of the agent delivery, onset of symptoms of poisoning, epidemiological evaluation and determination that symptoms were consistent with mycotoxicosis (*5*), collection of agent samples, recovery of delivery vehicle sample, analytical evaluation of those samples, and the unequivocal identification of mycotoxins in them (*6*). This is just one of a number of attacks for which multiple analyses and reports provide corroboration.

The Canadians are to be commended for the sustained high quality and objectivity of their analyses, and for their responsible interpretation of those analyses. We emphasize that the conclusions drawn above regarding their data are consistent with and supplement the larger body of evidence on which we have based our determination that toxins and other agents have been used for hostile purposes.

BARBARA A. B. SEIDERS
U.S. Arms Control and Disarmament Agency, Washington, DC 20451

REFERENCES

1. T. Beardsley, *Nature (London)* **320**, 669 (1986); J. Maddox, *ibid.*
2. L. Ember, *Chem. Eng. News* **64**, 23 (9 June 1986).
3. A. M. Haig, "Chemical warfare in Southeast Asia and Afghanistan: Report to the Congress" (Special Report 98, Department of State, Washington, DC, 1982).
4. G. P. Shultz, "Chemical warfare in Southeast Asia and Afghanistan: An update" (Special Report 104, Department of State, Washington, DC, November 1982).
5. G. Humphreys and J. Dow, Surgeon General Branch, Directorate of Preventative Medicine, "An epidemiological investigation of alleged chemical warfare/biological warfare incidents in Southeast Asia" (Department of National Defence, Ottawa, 1982).
6. J. J. Norman and J. G. Purdon, "Final summary report on the investigation of 'Yellow Rain' samples from Southeast Asia" (Canada Defence Research Establishment, Ottawa, 1986).
7. H. B. Schiefer, "Study of the possible use of chemical warfare agents in Southeast Asia: A report to the Department of External Affairs, Canada" (Toxicology Group, University of Saskatchewan, Saskatoon, 1982); H. Cohen and G. Neish, in *Biological and Chemical Warfare, First World Conference, 1984*, A. Heyndrickx, Ed. (Ghent, Belgium, 1984), pp. 177–209; *Handbook for the Investigation of the Allegations of Use of Chemical or Biological Weapons* (Department of External Affairs, Ottawa, 1985).
8. C. J. Mirocha, R. A. Pawlosky, K. Chatterjee, in *Biological and Chemical Warfare, First World Conference, 1984*, A. Heyndrickx, Ed. (Ghent, Belgium, 1984), pp. 210–218.
9. C. J. Mirocha, R. A. Pawlosky, K. Chatterjee, S. Watson, W. Hayes, *J. Assoc. Off. Anal. Chem.* **66**, 1485 (1983); R. T. Rosen and J. D. Rosen, *Biomed. Mass Spectrom.* **9**, 443 (1982).

Response: The government's case rests heavily on chemical data—the discovery of trichothecene toxins in six samples of water and vegetation and in a larger number of blood and urine samples collected in battle areas in Laos and Kampuchea. It also rests on the fact that trichothecene toxins were found on a small plastic bag given to Canadian researchers in Thailand, a controversy not addressed here. (It should be noted, however, that the Canadians who received the bag from a villager were doubtful of its provenance, writing in their report that they were "skeptical that it was the real container" from an aerial attack.)

Drawing by Eleanor Warner

With respect to the biological samples, there is a credible explanation for the presence of toxins that does not involve weapons. Trichothecenes are produced by molds, and it is possible that the food eaten by the test subjects was moldy.

More difficult to explain are the six samples of toxin-laden water and vegetation. In this context, the credibility of lab results is crucial. The importance of the new European data is that they fail to confirm the U.S. reports of biotoxins, and they fail on a large scale.

The total number of environmental samples of "yellow rain" from Laos and Kampuchea that have been tested is now more than 100. The first five of these, collected by the U.S. government, were examined by a laboratory at the University of Minnesota. Four were found to contain trichothecenes. A sixth sample obtained by ABC News tested positive in a Rutgers University lab. Since then, the U.S. Army and the defense establishments of Britain, Canada, France, and Sweden have tested similar samples. In no case have they replicated the early findings. While the nonreplication of the early data does not make them wrong, it certainly makes them less credible.

—ELIOT MARSHALL