The influence of Bacillus thuringiensis var. israelensis on the mosquito predator Notonecta glauca

Water bugs from the genus Notonecta belong to extremely efficacious predators of mosquito larvae in the entire holometabolous area (see e.g. Dubitskii in Laird M. and Miles J. W. (Eds.), 1982: Integrated mosquito control methodologies. Acad. Press, Orlando, 444 pp. and others). On the basis of our field observations we were able to confirm that biotopes densely populated with the common water-beetleman (most often Notonecta glauca Linnaeus, 1758 under Czechoslovak conditions) are usually bare of mosquito larvae because here their populations are not very numerous. Bacillus thuringiensis var. israelensis (B. t. i.) is at present given priority No. 1 in the programme Biological Mosquito Control (WHO — TDR/BCC/SGW — 7/84). Results of tests against target organisms demonstrated larvae 85% survival. In this case these larvae investigated by Mulligan and Schaefer (1980; Proc. Pop. 48 th. Ann. Conf. Mosq. Contr. Assoc. 19—20), Garza, et al. (1986; ibid., 23-25), Miura et al. (1980; ibid., 45-48). However, mortality was relatively high in

case larvae Toxorcohynes were fed by infected larvae Attega angustifil (Lacey L. A. and Dame D. A., 1982; J. Med. Entomol. 19: 469–469, and Lacey L. A., 1983; ibid. 20: 630–624). In order to find out to what extent using B. t. i. against mosquito larvae can influence populations of the common water-beetleman and, if need be, to evaluate the relationship between common water-beetleman and mosquito larvae we arranged the following experiment: Third and fourth instar larvae of Notonecta glauca collected in the field were by one placed into containers from transparent polystyrene with 2 del water and fed larvae of Culex pipiens. Larvae of the common water-beetleman were divided into the following groups:

Nos. 1–10 Control, fed by mosquito larvae
Nos. 11–40 Common water-beetleman fed by mosquito larvae, 2.81 x 10^10 spores of B. t. i./del added
Nos. 40–50 Common water-beetleman not fed, 2.81 x 10^10 spores of B. t. i./del added

For controlling the effectiveness of the B. t. i. spores, 30 larvae of C. pipiens not fed at all during the experiment were given to 3 containers marked K 1–3 and into 3 containers marked KB 1–3 we gave 30 larvae of C. pipiens + 2.81 x 10^10 spores of B. t. i./del. The water temperature in the containers fluctuated from 18–24°C. In the beginning of the experiment the respective amount of B. t. i. in a suspension was given to containers Nos. 11–45 and daily 10 live mosquito larvae were added. In view of the fact that the spore suspension in the microaquaria decreased in effectiveness, from the fifth day of the experiment a new dose of suspension of initial concentration was added every third day to the samples treated with B. t. i. Controls were performed daily. The amount of mosquito larvae surviving from the previous day and changes in the state of the common water-beetleman (exuviation or dead larvae) were recorded.

While in controls K 1–3 all larvae without exception completed development to the pupal stage, mosquito larvae in samples KB 1–3 (with B. t. i.) were found dead after 24 hours.

In the control of the common water-beetleman (Nos. 1–10) the amount of mosquito larvae killed by one individual within 24 hours fluctuated considerably (from 5–54). Under experimental conditions the mean consumption was 21 larvae within 24 hours. One common water-beetleman larvae died during the experiment, the others completed development up to the imaginal stage.

In the group of 15 common water-beetleman fed by mosquito larvae which consumed B. t. i. (Nos. 11–45) four died during the experiment, the others completed development until imaginal. After consumption of B. t. i. mosquito larvae for a certain period stayed motionless at water level. These already little mobile larvae were not attuned by the common water-beetleman.

The group of five common water-beetleman not fed at all but only kept in B. t. i. suspension (Nos. 46–50) completed development until the imaginal stage without exception.