SHORT NOTE

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Microsporidian infection of the alfalfa snout beetle, *Otiorrhynchus ligustici* (Coleoptera: Curculionidae), and biological protection of hop plants

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Abstract. Adults of the alfalfa snout beetle, *Otiorrhynchus ligustici* (L.), were collected in hop gardens near Žatec in Czech Republic, and examined for microsporidian infection. *Nosema otiorrhynchi* Weiser, 1951 causes a general infection. The spores are ovoid in shape and measure 3.8–4 × 1.8–2 μm. The incidence of *Nosema* infection ranged from 0 to 95% in samples from various sites. The prospects of introducing this microsporidian into populations of *O. ligustici* are discussed.

The alfalfa snout beetle, *Otiorrhynchus ligustici* (L.), is today a serious pest of hop plants. Its importance as a pest in Czech Republic has varied. In the 1950's it was a serious pest of the sugar beet, proving highly resistant to chemical insecticides. In subsequent years, when the practice of sowing sugar beets later in the year was combined with DDT treatement, *O. ligustici* populations diminished and remained undetected in alfalfa crops. The species has infested hop plants since about ten years ago. For most of the summer, the species is hidden in soil and in other vegetation in the vicinity of the hop gardens, so that no chemical treatment is effective. The bionomy of *O. ligustici* has been described by Petrlík & Štys (1969). The beetle has recently been reported in Canada (Loan, 1986) as a new pest; mass outbreaks have occured along the southern border of Canada near Lake Ontario and elsewhere in the province of Ontario, mainly in alfalfa fields.

I examined Czech populations of *O. ligustici* from several hop gardens in the regions of Žatec and Rakovník, and samples of the Canadian populations as well. Cases of mycoses caused by common deuteromycetes *Beauveria brongniarti* and *Metarrhizium anisopliae* were found only in adult beetles in the Canadian samples. Infection by the microsporidian *Nosema otiorrhynchi*, infesting first the Malpighian tubules and then, gradually, the other organs of adult beetles, has been described in Czech populations of *O. ligustici*. *N. otiorrhynchi* penetrates the egg follicles, and is transmitted through the egg into larvae of the next generation (Weiser, 1951). Between 1945 and 1950, up to 80% of the beetles collected in sugar beet fields were found to be infected; no beetles at all were found in the fields between 1951 and 1953; and 5–10% of the adults collected between 1958 and 1960 were infected. The infection reduces beetles' resistance to a chemical insecticide and accelerates its effects (Weiser, 1951; Rosický, 1951; Rosický & Weiser, 1951). We collected adult beetles during their spring swarming in April of 1990, either directly from root stocks or from soil near to the hop plants. Samples were taken in hop gardens at Čínov, Stekník, Postoloprty, Dobroměřice, Hředle, Nesuchyně and Kněževes. The beetles were killed by chloroform in Petri dishes, and examined microscopically for the presence of microsporidia.

The microsporidian invades the Malpighian tubules, fat body and ovaries of *O. ligustici*. Its spores are elongated and ovoid, with both poles obtuse and of the same width; the size of the spores ranges 3.8–4 × 1.8–2 μm. Vegetative stages were rarely present. The prevalence rate of infection in the individual organs varied among the samples, with individuals from populations with a high general incidence of infection mainly showing more serious symptoms of the disease. No coincidence was found between the infection and the mortality of beetles reared in the laboratory, which means that the infection is not the cause of conspicuously high mortality in adult *O. ligustici*. The proportion of infected egg follicles markedly

increased with age of the insects, and high mortality was predictable in the ultimate series of egg batches, which were full of spores.

The incidence of *Nosema* infection ranged from 0 to 95% in the sample populations (Table 1). Samples from the region of Rakovník (Hředle, Nesuchyně, Kněževes) showed no infection, while 23% of those from Dobroměřice and Postoloprty, and 49% in the Činov sample were infected. The most highly infected material came from Stekník (95%). The discontinuous, focal incidence of the beetles in the hop gardens corresponds to the focal, localized incidence of the disease.

TABLE 1. Occurrence of the microsporidian *Nosema otiorrhynchi* Weiser in adult alfalfa snout beetles, *Otiorrhynchus ligustici* (L.).

Locality	Number of adults		Infection
	examined	diseased	
Činov	73	36	49
Stekník	75	71	95
Postoloprty	64	15	23
Dobroměřice	120	27	23
Hředle	58	0	0
Nesuchyně	82	0	0
Kněževes	52	0	0

I was unable to infect beetles from localities free from infection with food (alfalfa) dipped in a suspension of spores, and the same method of transferring *Nosema* failed with Canadian *O. ligustici*. It seems that *Nosema* is transmitted from one generation to another through infected eggs, and that variation in the spread of the infection depends primarily on the rate of the infection's development in the beetles. There must be a period in an early larval stage when contamination occurs by food, or else spores must somehow be activated in the external environment. The development of the infection in foci with high prevalence rates will be monitored, in order to obtain data enabling us to introduce *Nosema* into healthy populations of *O. ligustici*. The microsporidian can thus become a suitable component of an integrated plan of hop protection.

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