

INTERACTIONS BETWEEN PARASITES AND PATHOGENS IN HELIOTHIS

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During the 1991-92 season, a 1 ha block of unsprayed raingrown cotton near Dalby was sampled for parasite activity in heliothis larvae. As the parasites of interest mainly attack small larvae (see Murray and Rynne 1992), parasitism levels were determined by weekly collections of third and fourth instars. A single release of about 200 female *Microplitis demolitor* Wilkinson was made on 17 January 1992 to supplement natural parasite activity. In this paper we present data on larval parasitism and discuss possible interactions between parasites and a recently discovered pathogen.

The number of parasitised larvae, expressed as a percentage of the number of parasited larvae plus the number of larvae surviving to pupation, peaked at 68% 12 days after *M. demolitor* release (Figure 1). The relative contribution of released and naturally occurring *M. demolitor* was not determined as they could not be separated. From larval collections on 22 January, 56% of recovered parasites were *M. demolitor*. *Chelonus* sp. was the next most abundant parasite, contributing 36% of total parasitism on 22 January, while *Campoletis* sp. was recorded in low numbers. On 29 January, *M. demolitor* contributed 83% of total parasitism.

During a second peak of larval infestation in late February - March, parasitism declined (Figure 1), despite an abundance of suitably sized larvae in the crop. This outcome was unexpected and may have been influenced by a disease caused by an *Ascovirus* infecting heliothis larvae. Slow development, pronounced segmentation and pale colouration of larvae indicated ascovirus infection. The incidence of ascovirus, as a percentage of total larvae collected, averaged 34% during late February and March. During the same period, about 43% of field collected larvae also died from unknown causes.

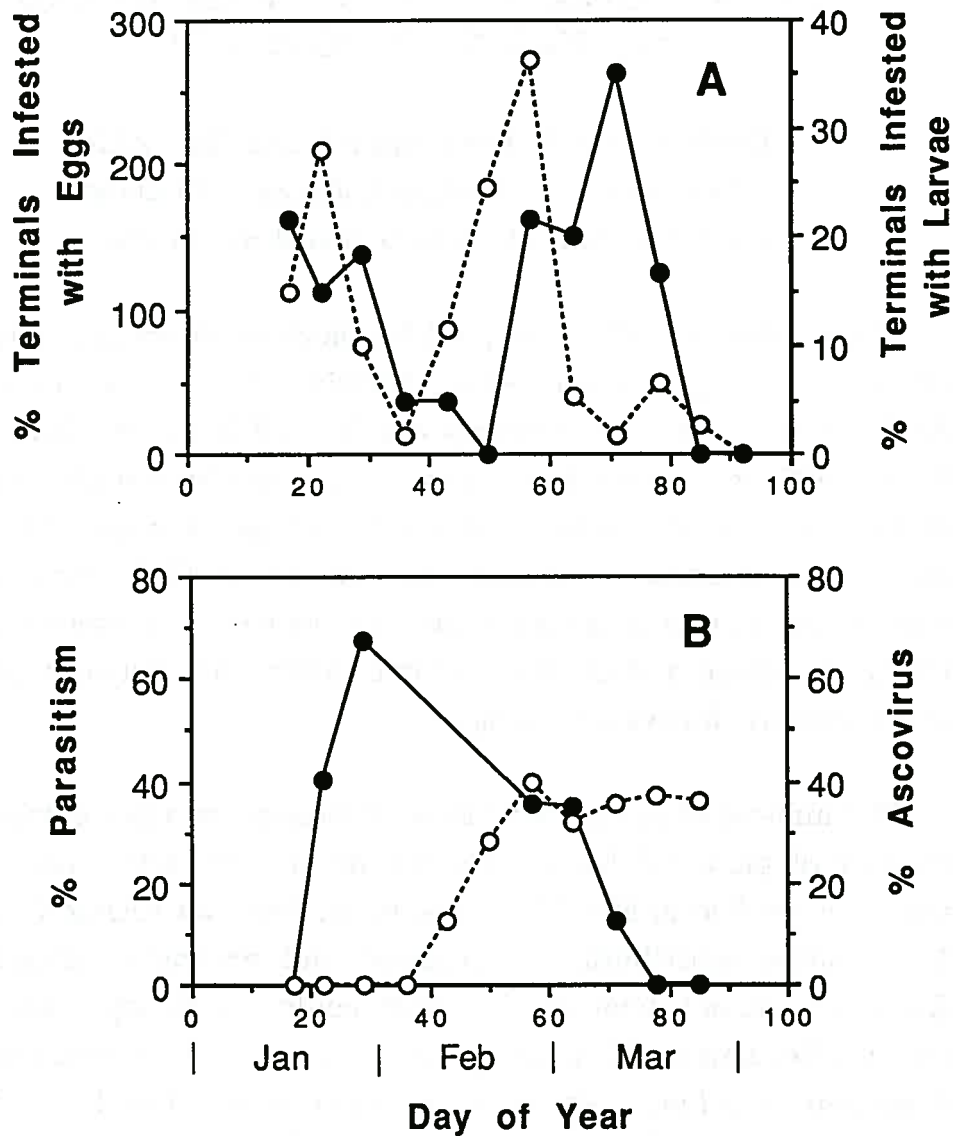


Figure 1. A. Percentage of terminals infested with heliothis eggs (o - - o) and larvae (●—●) and B. percentage parasitism of combined third and fourth instar heliothis larvae (●—●) and percentage larvae infected with ascovirus (o - - o) on unsprayed cotton near Dalby, 1992.

Ascoviruses are a newly discovered group of invertebrate viruses infecting larvae of heliothis and related Noctuidae. Viruses belonging to this group cause a chronic, fatal disease (Federici 1983). Infected larvae grow and develop much more slowly than healthy larvae, and eventually succumb to the disease.

Ascoviruses are not readily transmitted *per os*, but are easily transmitted by intrahaemocoelic inoculation. This has led to speculation that they may be vectored by insect parasites (Govindarajan and Federici 1990). Furthermore, internal parasites in larvae infected with ascoviruses may fail to complete development (Hamm *et al.* 1985).

If the incidence of ascovirus is a direct result of transmission by parasites, then it is reasonable to assume that in the absence of ascovirus much higher levels of parasitism would have been recorded during the latter part of this study.

Interactions between viruses and heliothis parasites have been reported previously. Prior parasitism by *Microplitis* sp. suppressed infection of *Helicoverpa armigera* (Hübner) by heliothis nuclear polyhedrosis virus (NPV) (Teakle *et al.* 1985). Conversely, the level of parasitism was lower when virus infection occurred first. In USA, virus-contaminated *M. croceipes* (Cresson) transmitted NPV to *Heliothis virescens* (F.) on soybeans (Young and Yearian 1990).

The inadvertent transmission of virus diseases by parasitic insects, and the complex interactions which can take place, highlight the difficulty of integrating some biological options into a management program. Further studies on the interactions of parasites and pathogens and their hosts are required to enable us to make best use of these biocontrol agents in pest control in cotton.

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References

Federici, B.A. (1983). Enveloped double-stranded DNA insect virus with novel structure and cytopathology. *Proceedings of the National Academy of Sciences, USA*. 80:7664-7668.

Govindarajan, R. and Federici, B.A. (1990). Ascovirus infectivity and effects on the growth and development of Noctuid larvae. *Journal of Invertebrate Pathology* 56:291-299.

Hamm, J.J., Nordlund, D.A. and Marti, O.G. (1985). Effects of a nonoccluded virus of *Spodoptera frugiperda* [Lepidoptera: Noctuidae] on the development of a parasitoid, *Cotesia marginiventris* [Hymenoptera: Braconidae]. *Environmental Entomology* 14:258-261.

Murray, D. and Rynne, K. (1992). Larval parasites - a biological option? (*these proceedings*).

Teakle, R.E., Jensen, J.M. and Mulder, J.C. (1985). Susceptibility of *Heliothis armiger* [Lepidoptera: Noctuidae] on sorghum to nuclear polyhedrosis virus. *Journal of Economic Entomology* 78:1373-1378.

Young, S.Y. and Yearian, W.C. (1990). Transmission of nuclear polyhedrosis virus by the parasitoid *Microplitis croceipes* [Hymenoptera: Braconidae] to *Heliothis virescens* [Lepidoptera: Noctuidae] on soybean. *Environmental Entomology* 19:251-256.