but differed significantly over time in characteristic regional patterns. Sediment granulometry (particle size distributions) differed significantly at the two study sites, and also varied significantly over time. Seasonal changes in nematode abundance correlated positively with seasonal changes in mean sediment temperature. No other significant correlations were found between seasonal changes in nematode abundance and the remaining physical field factors. Current findings support previous reports that nematode communities of estuarine habitats contain relatively few species, and exhibit marked seasonal differences, which correlate with seasonal temperature changes.

FOOD WEB INVOLVEMENT IN THE REGULATION OF CITRUS PESTS AND DISEASES BY ENTOMOPATHOGENIC NEMATODES. **Duncan, L. W.** University of Florida, Citrus Research and Education Center, Lake Alfred, FL 33850.

The foremost biotic threat to citrus in Florida is a pest-disease complex caused by the weevil *Diaprepes abbreviatus* and fungi in the genus *Phytophthora*. Due to deregulation of effective insecticides, many growers rely on commercial entomopathogenic nematode (epn) products to help manage soilborne stages of the insect. Augmentation of epn to reduce population densities of both the weevil and *Phytophthora* spp. can be profitable in groves located on Florida's central ridge. However, efficacy has been inconsistent and often poor elsewhere. Endemic epn species are a key factor regulating population density of *D. abbreviatus* on the central ridge, in contrast to some orchards examined in other regions. Coincidentally, *D. abbreviatus* is less abundant and damaging in orchards on the central ridge than elsewhere in the state. Regional variation in soil texture may be a factor in the variable response to epn use, the prevalence of endemic epn, and consequently, the distribution of *D. abbreviatus* in Florida. Due to significant natural control of *D. abbreviatus*, a better understanding of key food web relationships involving this insect on the central ridge could help to maximize profitabilily of biological control efforts. For example, evidence of greater persistence of endemic compared to exotic epn raises the possibility that competition from exotic epn, which can reduce the prevalence of endemic epn, may mitigate the value of nematode augmentation. Density dependent factors may govern the observed seasonality of natural control by epn. These factors include competition with free living bactivorous nematodes in the weevil cadaver, antagonism by nematophagous fungi, and parasitism by an epn-phoretic *Paenibacillus* species that reproduces in *D. abbreviatus* and impairs epn motility in soil.

ENTOMOPATHOGENIC NEMATODES IN THE EUROPEAN BIOCONTROL MARKET. **Ehlers, R-U**. Institute for Phytopathology, Department for Biotechnology and Biological Control, Christian-Albrechts-University Kiel, Klausdorfer Str. 28-36, 24223 Raisdorf, Germany,

In Europe total revenues in the biocontrol market have surpassed 200 million . The sector with the highest turn-over is the market for beneficial invertebrates with a 55% share, followed by microbials with approximately 25%. Annual growth rates of up to 20% have been estimated. Entomopathogenic nematodes (EPN) are exceptionally safe biocontrol agents. Until today, EPN are exempted from registration in most European countries, the reason why SMEs were able to offer economically reasonable nematode-based products. The development of technology for mass production in liquid media significantly reduced the product costs and accelerated the introduction of nematode products. Progress in storage and formulation technology has resulted in high quality products which are more resistant to environmental extremes occurring during transport to the user. Today three companies produce EPN in liquid culture. Major markets in the EU are the control of sciarid flies in ornamentals and mushrooms followed by the application against weevils in ornamentals and strawberries. Grubs and other scarabaeid species in orchards and turf are also controlled with EPN. Factors influencing success or failure in these applications will be discussed. Since the introduction of the Western Corn Rootworm *Diabrotica virgifera virgifera* into Serbia in 1992, this pests as spread all over the Balkan Region and has reached Switzerland, Italy, France and Austria in 2002. As larvae are highly susceptible to *H. bacteriophora*, the estabishment of this nematode in agriculture environments is a potential measure to provide sustainable control. Novel adjuvants used to improve formulation of EPN have enabled the foliar application against Western Flower Thrips and lepidoptera. The use of EPN in these markets requires another reduction in product costs.

SYMBIOTIC INTERACTION OF *HETERORHABDITIS BACTERIOPHORA* AND ITS SYMBOTIC BACTERIUM *PHOTORHABDUS LUMINESCENS* DURING NEMATODE DEVELOPMENT AND REPRODUCTION. **Ehlers, R-U.** Institute for Phytopathology, Department for Biotechnology and Biological Control, Christian-Albrechts-University Kiel, Klausdorfer Str. 28-36, 24223 Raisdorf, Germany.

Mass production of nematodes for biocontrol purposes is done in large scale bioreactors in liquid media. The development of the nematodes under artificial conditions differ from the life cycle in vivo. Exit from the dauer stage (DJ) of *H. bacteriophora* (recovery) is induced by a chemical signal excreted by the symbiotic bacterium *P. luminescens*. This signal is composed of at least 2 compounds, one of less than 20 kDa and are negatively charged and another of 5 kDa. Bacteria also secrete an antagonistic signal which inhibits nematode recovery. Since DJ recovery depends on the presence of the bacterial food signals, the percentage of recovering DJ in liquid culture is influenced by the bacterial density