INTRODUCTION

I. INTRODUCTION

The desert locust (*Schistocerca gregaria* Forskal) has threatened agricultural crops in desertic and semi-desertic zones of northern Africa, the Near East and South-West Asia for thousands of years, because it is a much feared pest, has great mobility and a vast invasion area. Despite the development of improved monitoring and control technologies, this threat continues to the present day. For example, there have been a major desert locust plagues since 1860, some lasting more than ten years, and several upsurges during the last 25 years, the most recent being in 1992-1994 **(FAO, 1996)**.

When locust upsurges and plagues develop, large scale control campaigns must be mounted on an emergency basis. These campaigns are expensive, use large quantities of pesticides and involve external assistance. During the upsurge and subsequent most major plague of 1986-1989, 40 countries were affected and 17.5 million hectars (ha) were treated and the cost of the international assistance (IA) alone to these efforts was of the order of USD 250-300 million apart from the substantial emergency resources provided by the locust affected countries. During the 1992-1994 upsurge nearly 4 million ha. were treated and the cost of IA to suppress the upsurge was estimated to be about USD 40-50 million **(FAO, 1994)**.

Ground and aerial application of chemical insecticides is the only viable method of locust control at present . Until the late 1980s, dieldrin was the most effective pesticide used in locust control due to its high toxicity and long persistency and relatively easy method of application. It was commonly applied as barriers on vegetation in locust infested areas. However this pesticide has now been withdrawn from use because of its potential effects on the environment **(FAO, 1996)**.

Disadvantages of chemical insecticides including development of insect resistance, ground water contamination, food hazards and destruction of natural enemies serves as a strong impetus for the development of alternative insect control measures. Particular attention in recent years has been focused on biological control using entomopathogenic nematodes.

Entomopathogenic nematodes in the families Steinernematidae and Heterorhabditidae are soil inhabiting insect pathogens that possess potential as biological control agents **(Gaugler, 1981; Kaya, 1985a; Poinar, 1986; Gaugler and Kaya, 1990; Kaya and Gaugler, 1993)**. The third-stage infective juveniles (IJs) of these nematodes are mutualistically associated with bacteria *Xenorhabdus* and *Photorhabdus* sp. **(Kaya, 1993)**. Together, they possess unusual virulence, killing insects within 24-48 hr. Steinernematid and heterorhabditid nematodes can parasitize thousands of insect species including many economic pests **(Poinar, 1979)**. Despite their broad host range and high virulence, these biocontrol agents show no mammalian pathogenicity **(Gaugler and Boush, 1979)**. United States Environmental Protection Agency (EPA) has subsequently exempted them from registration and regulation requirements **(Gorsuch, 1982)**. Mass production methods have been developed to the point that nematodes are competitive economically with many chemical insecticides and they often provide levels of insect control comparable to that of chemicals **(Georgis and Gaugler, 1991)**. No other biological control agent offers a comparable combination of attributes: broad host range, high virulence, inexpensive mass rearing, and safety **(Poinar, 1990)**.

Despite this impressive list of attributes, the sensitivity of steinernematid and heterorhabditid IJs to inactivation by extremes of the physical environment prevents them from reaching their full potential **(Gaugler and Kaya, 1990)**. The intolerance of infective stages to desiccation **(Kamionek *et al.*, 1974)** and temperature **(Molyneux, 1986)** has contributed to erratic results in the field **(Gaugler, 1981; Akhurst, 1986)**. Because many economically important insect economically important insect pests inhabit the plant canopy, several attempts have been made to apply nematodes to foliage and overcome the desiccation limitation **(Mac Vean *et al.*, 1982; Kaya, 1985a,1986)**. Collection of novel indigenous isolates of entomopathogenic nematodes has merits to alleviate such problems. It may provide isolates more suitable for inundative release against local pest insects because of adaptation to their climate and population regulators **(Bedding, 1990)**.

The aim of this work is to evaluate the possibility of using the entomopathogenic nematodes as biological control agents against the desert locust, *S. gregaria,* to determine the effect of certain physical environmental factors on the nematode survival and to study the cellular and humoral immune response of *S. gregaria* nymphs infected with steinernematid and heterorhabditid nematodes. Finally a semifield experiment was also conducted to test the performance of the most virulent entomopathogenic nematode strain against the desert locust.