f Three Tropical

: Freiburg i.Br., GERMANY

:otropical and one
re monitored
recordings from different
·d distinctively different
ribution among the three

ıity (Rio Aguarico, Ecuador)
levels, occupying all
een 3 and 10 kHz, and
s "acoustically saturated".
istributions of frequency
. might result from local
acoustic avoidance. Song
h a 2 hour period of maxi-

:alda, Prov. Amazonas,
diversity at middle and
ides with the highest
wise impoverished white-
observed all day, but peaks
.g, with a high acoustic
species.
Kinabalu Park, Malaysia,
ity due to the clumped
few abundant species
evenly distributed, resulting
sampled acoustically or by
s completely suppressed by a
emely loud cicada species,
mole cricket chorus (Gryllotal-
ts (Gryllidae) after 19:00 local

ı of cricket diversity with
Neotropical forests.
·e approach to more tropical
ver, such projects have to be
rovide common access to
databases. It is proposed to
WWW. Examples of songs
e at http://www.biologie.uni-
nl
earch Council (DFG) and the
, Project Nr. P11564 -BIO to H.

ıd Production in

STEPHEN
y of Nottingham, UK Depart-
y of Leicester, UK

:a involves mechanical
paratus is such that a complex
erated, although the analogue
Also the sound spectrum
changes within the course of a single syllable. There is evidence to show that for many species only particular frequency components are used for species recognition and location. Some species have the ability to intensify and filter selected frequencies, using the subalar air space as a resonator. The effectiveness of this system is confirmed by the use of models.

Biological Control of Locusts and Grasshoppers in Russia and CIS Countries

MICHAEL G. SERGEEV AND ALEXANDRE V. LATCHININSKY

[MGS] Department of General Biology, Novosibirsk State University, 2, Pirogova St., Novosibirsk 630090, RUSSIA— [AVL] All-Russian Institute for Plant Protection (VIZR), 3, Podbelsky street, Saint-Petersburg - Pushkin 189620 RUSSIA

Biological control is a contradictory approach to plant protection. It allows us to prevent chemical pollution, but its efficiency is limited by natural conditions, coevolution patterns, and unpredictable results, making it complicated to use. Some forms of biological control (viral, bacterial, fungal, plant products) have been used for regulating locust and grasshopper outbreaks.

In the Russian Empire, some parasites, parasitoids (mainly insects), and predators were reported by Koeppen, Rossikov, Mechnikov, Krasilstshik, and some other investigators. These studies were continued in the USSR. From the 1920's to the 1950's a lot of grasshopper and locust enemies were reported and evaluated. Among them were viral, bacterial, and protozoan (*Gregarina* spp., *Nosema*) forms, fungi (*Empusa, Beauveria, Aspergillus* et al.), insects (Meloidae beetles, Bombyliidae, Chloropidae and Sarcophagidae flies, Scelio), mites, nematodes (especially Mermitidae), and nematomorphs. Some of them are associated with eggs, some others with larvae and adults. Opportunities for using these species and groups for biological control were limited by the necessity of breeding large numbers for release. Vinokurov tried to use the fungus *Entomophtora grylli* for the control of some Siberian grasshopper species.

The rapid expansion of comparatively inexpensive and highly effective chemical agents diminished interest in alternative control strategies until the 1980's. As a rule, only some unicellular species and fungi were used for special studies. Some microsporidian forms (*Nosema* spp., *Microsporidium italicus*) are promising for population regulation of the Moroccan, Italian and Migratory Locusts. *Nosema chorthippi* may be used for the abundant grasshopper *Chorthippus albomarginatus*. Issi et al. (1993) proposed some fungal pathogens for possible use: *Entomophthora grylli, Cephalosporium lefroyi, Beauveria bassiana, B. tenella, Metarhizium anisopliae, Verticillium lecanii,* and *Paecilomyces farinosus*. Regarding nematodes, Danilov and Karpova (1990) reported 96% mortality of hoppers of *C. albomarginatus* in Yacutia after application of a water suspension of *Steinernema carpocapsae* These results allow us to discuss possibilities of using both biological and chemical agents.

Now new ideas in biological control should be developed, especially related to the breeding and application of biological agents.