

Research on animal resources at the Department of Natural Resources, Institute of African Research and Studies, Cairo University

By

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Abstract

Department of Natural Resources was established in 1971 as part of the Institute of African Research and Studies. Research on animal resources was concentrated early beginning on earthworms in the Nile Delta and Valley. After few years, research was conducted to include the whole community of animals that were temporarily or permanently live in the soil, i.e. soil fauna, and more specifically on the invertebrates with very few exceptions.

Introduction

Department of Natural Resources was established in 1971 as part of the Institute of African Research and Studies. Research on animal resources was concentrated early beginning on earthworms in the Nile Delta and Valley. After few years, research was conducted to include the whole community of animals that were temporarily or permanently live in the soil, i.e. soil fauna, and more specifically on

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the invertebrates with very few exceptions. The research topics include surveys and applications. Surveys were conducted in order to know what species are present and the structural composition of their communities. These include ecological and biological studies to the whole community and/or group of taxa. The applied research includes studying the effect of each of agricultural practices, protection from grazing, type of vegetation cover and weed control by physical methods on population ecology of soil animals in deserts, desert agro-ecosystems and in the Nile Delta and Valley. The applied research was extended to study biological control of pests associated with variety of crops using viruses, fungi, predators, plant extracts, parasites, changing plant dates and poly-culture in order to minimize the use of chemicals and prevent environmental pollution. Recently, diversity of soil animals as affected by several ecological factors in different habitats was of continuous study. Apart from the terrestrial habitats the fresh and marine aquatic habitats were taken into consideration. Snails and their associated plants and mosquitoes and their predators were studied in the Nile water. Community structure of the reef-building corals at some locations in the Red Sea was studied. Few studies dealing with larger vertebrates were taken into consideration. Such studies deal with blood parasites in cattle and buffaloes, poultry nutrition, digestibility of some fodder plants for increasing production of small ruminants and incidence of mycoplasma infection in chickens and its effect on productivity. All of these researches were carried out in the Western and Eastern deserts, Sinai and Nile Delta and Valley of Egypt and extended as far as Sudan, Uganda, Kenya, Tanzania, Zambia, Zimbabwe and Nigeria.

Ecological and Survey Studies

Soil fauna are one of the most important biotic resources inhabit the soil. They are very interdependent and their populations form complex interactive systems usually referred to as the soil community. The diversity, frequency and abundance characterize the populations of soil animals are differ greatly among different habitats, communities and ecosystems. The most important function of soil organisms, including soil animals, is to regulate the dynamic soil processes, which maintain soil fertility. Many factors can have drastic and markedly differential effects on populations of the various taxa of the soil fauna and microflora, which often lead to dramatic changes in the structure of soil communities. They can cause considerable decreases in diversity and changes in the relative abundance of soil organisms. Such changes affect the function of soil communities, particularly in terms of changing the rates of organic matter breakdown and nutrient cycling.

The research topics include surveys and applications.

Desert Areas

Surveys were conducted in order to know what species are present and the structural composition of their communities. These include ecological studies to the whole community and/or group of taxa. The ecology of soil mesofauna of the western Mediterranean coastal desert of Egypt was studied from different points of view and in different habitats: summer populations in the littoral sand dunes (Ghabbour et al. 1977 and Mikhail 1987), soil mesofauna associated with *Thymelaea* shrubs (Ghabbour and Mikhail 1978), in the Mariut frontal plain (Ghabbour and Shakir 1980) and in the Omayed Biosphere Reserve (Mikhail 1982). The characteristic species or taxa of soil mesofauna

within a number of sites representing an ecological/environmental gradient in this region was studied by Ghabbour et al (1984), Cancela da Fonseca et al. (1984) and Ghabbour et al. (1985 and 1987). Recently, soil fauna under major shrubs in grazed and protected plots at the Omayed Biosphere Reserve regarding population density (Mikhail 1992) and species area relationships (Mikhail 1993a). Diversity of soil mesofauna was also studied in the Mariut region by Mikhail (1996). Soil mesofauna was studied in the middle sector of the Mediterranean coastal land (Deltaic) by Mikhail (1987), Ghabbour and Mikhail (1993a) and (1993b), and activity density of soil mesofauna in peach orchard in Rafah city in North Eastern part of Egypt, Sinai (Mikhail 1995 and 1998).

Moving from the coastal habitats, works on soil fauna were done in the Nubian Desert in the extremely arid southeastern part of Egypt, and in different habitats. Population ecology of soil fauna in Wadi Allaqi area (Mikhail and Sobhy 1992a) and Wadi Quleib area (Mikhail and Sobhy 1992b), land reclamation and ecological equilibria of potential pests among soil fauna in Dihmit farm (Mikhail and Sobhy 1992c), effect of soil structure on soil fauna of this area (Mikhail 1993b) and the functional groups of soil mesofauna populations as components of ecosystem maturity in this area (Mikhail et al. 1995b). All the above mentioned studies enable Ghabbour et al. (1993) to study chaos and order in ecosystems and the problem of pest outbreaks in relation with herbivore soil fauna in a coastal desert grazing land ecosystem and population density-biomass relationships soil mesofauna in unstable environments in the Egyptian Deserts could be studied (Ghabbour and Mikhail 1997).

Desert agriculture

Moving from the studies of soil fauna in desert areas, the desert agriculture in newly reclaimed lands was studied from different points of views and habitats: some features of important taxa of soil mesofauna in an Afro-Mediterranean coastal desert dealing with the general consideration of soil mesofauna in agro-ecosystems (Shakir 1980, Ghabbour and Shakir 1981), soil mesofauna associated with irrigated vineyards (Ghabbour and Shakir 1983), and soil mesofauna associated with dry-farmed olive (Ghabbour and Shakir 1984/85). The population parameters of soil mesofauna in agro-ecosystems of the Mariut region was, also, studied from different points of view; under dry-farmed almond (Ghabbour and Shakir 1982a), under dry-farmed fig (*Ficus carica*) (Ghabbour and Shakir 1982b), seasonal variation in a community of soil mesofauna under annual field crops (Ghabbour and Shakir 1982c), and population density and biomass of earthworms in agro-ecosystems of Mariut coastal desert (Ghabbour and Shakir 1982d).

Old land

Works of soil fauna in the Nile Valley and Delta was carried out in different habitats. Zedan et al., (1993) studied the recovery of soil fauna after insecticide treatments in a cotton field at Etsa. Mikhail et al. (1995a) studied the effect of bio-pesticide and chemical insecticide treatments on some non-target soil fauna, impact of no-tillage agriculture on soil fauna diversity (Rizk and Mikhail, 1999), effect of irrigation in mixed tomato cultivation on activity density of the collembolan *Friesea claviseta* (Rizk et al. 2000), soil fauna associated with medicinal and aromatic plants (Ghabbour et al. 2000), relationships of irrigation regimes and intercropping with pest infestation of tomato (Rizk and Mikhail 2000a) and impact of

Agrispon (a soil conditioner) on soil fauna in maize fields (Rizk and Mikhail 2000b), all of these studies were done in Fayoum Governorate. In Menoufiya Governorate, studies on soil mesofauna were done from different points of view; the activity density of soil mesofauna associated with potato fields (Mikhail and Hussein 1997), evaluation of agricultural pests in tuber crop plantations (Hussein and Mikhail 1998), the relationship of irrigation water and herbivore communities associated with vegetable crops (Mikhail et al. 1998) and populations of functional groups of soil mesofauna in non-tuber vegetable crops (Hussein et al. 1999). In Beni-Suef, soil fauna were studied in cultivated lands either those associated with mixed fruit trees (Gadallah and Mikhail 1999) or associated with citrus orchards (Mikhail and Gadallah 1999). In Giza Governorate, Sharawy (1999) studied weed control by non-polluting physical methods in citrus orchards and their impact on soil fauna populations. The studies extended to dust mites in some dry habitats (Abdel-Azeim 1999). Pest survey as carried out on some agricultural pests in northern Nigeria (El-Tonsi 1984).

Landuse and soil fauna

Some groups of soil animals could also be useful to distinguish changes in landscape due to intensification of agriculture systems in the Mariut region, on the Mediterranean coast west of Alexandria (Ghabbour et al. 1985), or a variety of grazing management systems in the same region (Cancela da Fonseca et al. 1984). The various ordination and classification techniques used in these studies were also used to differentiate habitats of the highlands of the Sudan and Ethiopia based on there soil fauna population (El-Shishiny and Ghabbour 1989), in lake Naivasha area in Kenya (Mikhail and Sobhy 1991), in agro-ecosystems in Tanzaniz and countries of North East

Africa (Sobhy 1992), in Mount Meru area in Tanzania (Mikhail et al. 1997b.), in number of tropical African countries (El-Shishiny and Ghabbour 1987), in different habitats of Egypt and Africa (El-Shishiny and Ghabbour 1988) and in Ethiopian highlands and Arabian Peninsula (Kheirallah and Mikhail 1995). These same techniques were also used to follow the recovery of a cotton plantation in Fayoum (in Middle Egypt), to "normal" conditions after insecticide application (Zedan et al. 1993), and in following the development of an incipient agro-ecosystem in the barren desert east of lake Nasser in southern Egypt, as compared to the more or less equilibrium conditions in two nearby wadis (Mikhail and Sobhy 1995 a and b). Mikhail (1993b) could also indicate the subtle relationships between soil fauna species and various soil types in two desert wadis in SE Egypt. Moving from these localized studies on a national scale, Ghabbour and Mikhail (1993a) could classify Egyptian habitats on the basis of their soil fauna populations, and point out the characteristic taxa for each of these habitats.

Applied research

Laboratory studies

Laboratory studies were carried out in order to understand ecological and physiological behaviour of some certain species of soil animals such as *Heterogamia syriaca* Sauss. (Polyphagidae, Dictyoptera), a major components of the soil fauna in the Mediterranean coastal desert of Egypt, regarding variation in its chemical composition (Ghabbour and Mikhail 1977) and water relations (Ghabbour et al. 1992). Other taxa of soil animals were selected to study their activities in the areat of North Africa (Rizk 1980) and their consumption of plant litter in the Governorate of Tripoli, Libya (Rizk 1989).

Pest control studies

The applied research includes studying the effect of each of agricultural practices (Shakir 1980; El-Attabi, in Prep.), protection from grazing (Hussein 1985, Mikhail 1992 and 1993a, Ghabbour et al. 1996a and b), type of vegetation cover (Abdel-Malak 1989) and weed control by physical methods on population ecology of soil animals in deserts, desert agro-ecosystems and in the Nile Delta and Valley (Sharawy 1999). The applied research was extended to study biological control of pests associated with variety of crops using viruses (Mohamed 1997), fungi (Nada 1999), predators (Gafar, in Prep.), plant extracts (Ismail 2000, Younes 2000), changing plant dates (Zedan et al. 1991), poly-culture (Ghabbour et al. 1994) and the control of pests associated with ornamental and medicinal plants using some methods used in integrated pest management (Takawi, in Prep.). The work will extend in the near future to use parasites for controlling pests associated with some field crops. These researches were carried out in order to minimize the use of chemicals and prevent environmental pollution. The applied research was take another approach in order to study agricultural pests in Zambia and the role of invertebrate community in biological turn over in different agro-ecosystems (El-Tonsi, no date).

Diversity studies

Recently, diversity of soil animals as affected by several ecological factors in different habitats such as diversity of soil mesofauna in the Mariut region (Mikhail 1996), soil fauna diversity in arid lands of North Africa (Ghabbour 1996), biodiversity of functional groups of soil fauna communities in a variety of habitats in North East Africa (Mikhail et al. 1997a) and the relationships between phyto-diversity with zoo-diversity in Egypt (Ghabbour and Mikhail 1998). Diversity of animal wildlife resources were carried out to include regional scale such as in East Africa (Sobhy 1999), in Egypt and Morocco (Ghobrial, no date) and the Sudan (Fayed, in Prep.).

Rural ecology studies

Studies of rural ecology in the Nile Delta agro-ecosystems with different points of views such as energy flow in Al-Zawamel village (Omar 1987), material cycling in Al-Kateba village (Hamada 1989), the indicators for the sustainability of agro-ecosystems in Africa (Hamada 1997) and the use of agricultural chemical and their ecological impacts on animal resources in East African countries (Omar, no date).

Other Studies

Aquatic habitats

Apart from the terrestrial habitats the fresh and marine aquatic habitats were taken into consideration. Snails and their associated plants (Barsoum 1987) and mosquitoes and their predators (Galal 1993) were studied in the Nile water. Studies in marine aquatic habitats on reef-building corals in some locations in the Red Sea include: their ecology and distribution (Ammar 1996), community structure and diversity (Abo-Hegab et al. 1999) and effect of oil pollution on their distribution (Mikhail et al. 1999).

Large vertebrates

Few studies dealing with larger vertebrates were taken into consideration. Such studies deal with blood parasites in cattle and buffaloes (Rizkalla 1991), poultry nutrition (Ibrahim 1996), digestibility of some fodder plants for increasing production of small ruminants (Ismail 1999) and the incidence of mycoplasma infection in chickens and its effect on productivity (Hlashed, in Prep.).

Areas of research

All of these researches were carried out in the Western and Eastern deserts, Sinai and Nile Delta and Valley of Egypt and extended as far as Libya, Sudan, Uganda, Kenya, Tanzania, Zambia, Zimbabwe and Nigeria.

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