

## SHORT COMUNICATION

# MIGRATION AND POPULATION OUTBREAKS OF MILLIPEDES IN THE COFFEE PLANTATIONS, REGION OF ALTO PARANAIBA, MG, BRAZIL

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**Key words:** Diplopoda; millipedes, migrations; population outbreaks; population control

Migrations and population outbreaks of millipedes are phenomena that, due to their unpredictability, have attracted the attention of researchers in order to obtain information for a better understanding of this occurrence and for the adoption of efficient control methods when these arthropods cause damage to urban and cultivated areas.

Cloudsley-Thompson (1949) reported that individuals of *Fontaria virginensis* spread over an area of 75 acres in West Virginia (USA) farms in such large numbers that cattle were unable to graze and workers were nauseated by the odor exhaled by dead diplopods. At night and on cloudy days they moved in large numbers; most of them (a number estimated at 65 million animals) were killed by the heat of the sun. Nijima e Shinohara (1988), in turn, reported that in Hungary in 1878, in France in 1900, and in Germany in 1906 and 1938, railroad tracks had to be covered with sand for train wheels to be able to adhere to them. In the same article, they pointed out that in Japan the millipede *Parafontaria laminata* became known by interrupting railroad traffic and emphasized that the population explosions of this millipede occurred at 7 to 8 year intervals and that most of the animals found were adults or sub-adults. This fact has

raised speculations about the fact that mating could be a probable cause of such explosions.

In Brazil, since the beginning of the 90's, a population expansion of the millipede *Plusioporus setiger* (Brolemann, 1901) (Spirostreptida: Spirostreptidae) has been observed in coffee plantations in the Alto Paranaíba region, MG (18°37'-19°00'S; 46°52'-47°30'W) – a "cerrado" region that was deforested in the 70's for coffee culture. The infestations probably started in the coffee plantations of the Macaúbas Farm – Patrocínio, and today reach coffee plantations in Monte Carmelo, Iraí de Minas and Ibiá. The phenomenon has been attributed to organic fertilization and irrigation of the coffee plantations and also to the use of chemical pesticides that may have eliminated possible competitors. These practices have created an environment highly favorable to the survival of millipedes, which are adapted to locations with large amounts of organic matter and high relative humidity (BOCCARDO *et al.* 1997)

There are no recorded data demonstrating whether *Plusioporus setiger* was introduced or is a species native to the region. However, the species is known to be able to migrate and to adapt to conditions artificially created by man. Indeed, migration is a characteristic of various millipede species and in situations such as those observed in Patrocínio and Ibiá, although they do not damage the coffee plantations, the animals accumulate in river sources, invade houses and damage vegetable gardens and small plantations, especially during the rainy season. A study conducted during the dry season in order to assess the "hibernating" population of *P. setiger* revealed an alarming number of approximately 300 millipedes/m<sup>2</sup> (BOCCARDO *et al.* 1999b)

Many attempts have been made to contain the population outbreaks of *Plusioporus setiger* in the region by chemical control, without satisfactory results. Several insecticides have been found to be of low toxicity since millipedes, especially during the adult phase, present a rigid and calcified exoskeleton that may act as a barrier against the penetration of chemical products applied by spraying (BOCCARDO & FERNANDES, 2000; BOCCARDO *et al.* 2001)

There is no consensus about the origin of the organic matter introduced in the coffee plantations of the Macaúbas Farm. It has been proposed that this organic matter may have been brought from the State of São Paulo, or from Paraná, carrying with it the species in question. In the case of the Monte Carmelo and Iraí de Minas farms, the population expansion was facilitated by the proximity to the Macaúbas Farm. It should also be pointed out that these farms (belonging to different municipalities) are located along a highway and represent an area not interrupted by barriers such as towns, rivers etc., a fact that has facilitated migration. However, in the case of the Shimada Farm located between the municipalities of Ibiá and São Gotardo, MG, one of the farms more heavily attacked, the migratory process cannot explain the population expansion of *Plusioporus setiger*, since the farm is located in a position opposite to that of the

remaining ones, interrupted by the town of Patrocínio and other geographic barriers. The species is believed to have established itself there through the exchange of machinery, coffee plant cuttings, vehicles etc. originating from other infested farms.

Today the *Plusioporus setiger* population is greatly reduced on the Macaúbas Farm – Patrocínio. However, there still are some adults and the presence of eggs and of juvenile individuals may indicate the occurrence of new outbreaks. On the other farms, including the Shimada Farm, there are large amounts of adult and young individuals and the presence of many eggs observed during the rainy season may indicate that the outbreak will continue to be present in the region at least as long as conditions are favorable.

Thus, due to the migratory characteristic of this millipede, it is probable that the population outbreak will continue to extend to other coffee plantations, possibly causing economic losses in addition to disturbances in human dwellings. Although no damage to the coffee plantations was observed, it is important to point out that *Plusioporus setiger* has been found to be a potential consumer of vegetables such as lettuce, potatoes, beets, carrots and manioc in the laboratory.

Since the beginning of outbreaks in coffee plantations, investments have been made in research and alternatives have been sought for the control of these arthropods. Some emergency measures have been suggested, such as cleaning the land around the houses to prevent millipede accumulation and using a specific varnish on the walls to prevent the animals from climbing them and entering the house.

Biological control through the use of entomopathogenic nematodes has been proposed since several chemical control attempts have been unsuccessful. The first laboratory assays have been performed and have yielded satisfactory results.

In parallel to these assays, awheat bran bait was elaborated containing an organophosphorus insecticide (Diazinon) that demonstrated high efficiency in the control of diplopods under laboratory conditions (LAGO-MEIRA *et al.*, 2001).

In summary, the objective is not to exterminate millipedes in the region but rather to control their populations. From an ecological viewpoint, millipedes cannot be considered to be "pests" since they play an important role in the maintenance of equilibrium in ecosystems by contributing to the decomposition of organic matter and to the enrichment and humidification of soil (BOCCARDO, 1991; HOPKIN & READ, 1992). Thus, the conservation of the productive integrity of soil should be insured. However, the introduction of new conservation practices should be implemented as long as they are previously planned in order to prevent environmental impacts and consequent damage to man and to other animals.

## ACKNOWLEDGMENTS

The projects involved in this study were initially supported by Conselho Nacional de Pesquisa-CNPq, Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP and Centro de Estudos Ambientais, UNESP, Rio Claro Campus, and are currently supported by Instituto Mineiro de Agropecuária, Fazenda Shimada- Ibiá/MG, FINEP and Universidade Estadual do Sudoeste da Bahia – UESB, Jequié Campus, BA, Brazil.

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