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On August 18th 1992, Professor Bohdan Pисarski died suddenly, whilst carrying out his field work in Finland. Death took him from us while his creative abilities were still at their height. Up to the last day of his hardworking life he was actively researching the colonies of ants living on rocky islands off the Finnish coast near the Tvärminne Zoological Station.

Bohdan Pисarski was born in Warsaw on November 8th 1928. His secondary education he began in an “underground” course at Brwinów and obtained his maturity exam certificate at the T. Reytan Grammar School in 1947. In the same year, he took up studies in the Mathematics-Natural Sciences Department at the Warsaw University. He specialized in zoology, and focussed his interest on ants. He obtained his M. Phil. diploma in zoology in 1952.

His professional work commenced while he was still studying, and on January 1st 1949 he was made an Assistant at the State Zoological Museum in Warsaw. In 1956, he became a Senior Assistant, and also began his work on the ants of Afghanistan. He presented a synthesis of these studies and, in 1964, defended it at his Ph. D. viva before the Scientific Council of the Institute of Zoology of the Polish Academy of Sciences. The following year he was appointed an *Adiunkt*. He then began to research the fauna of the Bieszczady Mountains. Within this, he worked on the structures of colonies of *Formica exsecta* and their morphological, ecological and ethological implications. This subject was the one he chose as his dissertation for assistant professorship. It was viva'd at the Warsaw University in 1974. In the following year, he was made an Associate Professor at the Institute of Zoology, PAS. He was given the title Professor by the State Council in 1983.

In looking at Professor Pисarski's scientific work, it is possible to note a clear development of interest associated with the broadening and deepening of research in his field.

In the first period of his scientific activity he was engaged in faunistic and systematic research on ants. Initially, he confined this research to the ant fauna of Poland (9 papers). However, he quickly began to widen his field of interest to include the ants of the eastern Palaearctic – the Near East (4 papers), central Asia (4 papers), and then also the Orient (5 papers). He continued with this research to the end of his scientific activity, albeit at slightly lower intensity. Particularly interesting are his attempts to introduce new features into the interpretation of systematic links. Co-operation with the Department of Genetics of the University of Helsinki and the Department of Comparative Endocrinology of the University of Athens (Georgia, USA) made it possible for him to obtain data on the iso-enzymes and pheromones of ants, which he applied as systematic features. The results of this research are contained in 5 published works by teams of authors, including two in *The Biosystematics of Social Insects*, published by the Systematics Association.

Knowledge of the Polish ant fauna increased considerably as a result of Professor Pisarski's systematic and faunistic research, which has been summarized in the part of the Catalogue of the Polish Fauna devoted to ants. His research also filled some gaps in knowledge of the distribution of Palaearctic ants, particularly those of Mongolia and Afghanistan. His work brought descriptions of 29 species and subspecies of ant from the Palaearctic parts of Asia, which were new to science.

The activities and achievements of Professor Pisarski in this period have been characterized most fully by Professor Witold Koehler. He points out that Professor Pisarski's scientific debut was a carefully prepared one. He applied quantitative methods of analysis even in his first work, on the ants of the Kazimierz area. He also gave consideration to the phytosociological differentiation of his research area, to its soil and geological conditions, and to the anthropogenic transformations to which that environment was subject. In summing up his evaluation of the systematic and faunistic works, Professor Koehler writes: "Above all, Dr. B. Pisarski is a systematist who, in working on this specialism, brings together all the elements of his multi-faceted cognition to make a taxonomic diagnosis. For him, the laboratory and the field are of equal and complementary value as workshops".

In 1969, Professor Bohdan Pisarski started his research into the organization of ant societies as well as on the formation of competing communities of these insects. In the results, it was recorded that individual forms of the social structure of colonies represent successive stages in the sociogenesis of colonies. The morphology and behaviour of ants are connected with the type of social structure. The worker ants of more highly-organized colonies are smaller, darker and less hairy. In their behaviour it is possible to note reduced aggressiveness towards individuals of their own species from other colonies. Polycalic ant societies are more permanent than monocalic ones and they exert stronger biotic pressure on the environment. These studies explain the process by which polycalic colonies of ants arise and develop. They also account for the founding of filial ant hills by groups of workers. In the course of this research, a detailed study was made of the territoriality of *Formica exsecta*, the pattern species used by Professor Pisarski in research into the development of the social organization of ants. At the same time he stated that, when compared with species which do not show territoriality, those with strongly-expressed territoriality represent a higher position in the biological hierarchy of ants with developed social organization.

These works have been evaluated highly by zoologists as they cast new light on the development of insect societies and its biological consequences. In 1978, the International Union for the Study of Social Insects considered his cycle of studies on the organization of polycalic ant colonies to be one of the most important achievements of myrmecology in the 1970s. In recognition of this it was Professor Pisarski who was given the task of preparing papers for the opening sessions of the VIIth International Congress of the IUSSI, which took place in London, and the 16th International Entomological Congress, which was held in Kyoto in 1980.

This subject matter was developed further through research connected with practical and theoretical aspects of artificial colonization of wood ants (1985–1990).

After 1974, Professor Pisarski's activities began to embrace a new theme – urban ecology. Fifteen papers were devoted to this subject, and these were, to a great extent, team efforts from the school that was developing around him. Amongst his outstan-

ding achievements were the synthetic work on the origins of the fauna of urbanized areas, and critical studies on faunal synanthropization and the formation of homeostatic systems within urban animal communities. Two studies are of particular significance. These are the three-volume monograph entitled "Species Composition and Origin of the Fauna of Warsaw" (1981–1982) and the two-volume "Structure of the Fauna of Warsaw; effects of urban pressure on animal communities" (1986–1987). Professor Pisarski's participation as an editor and an author was considerable in both cases and, to date, these are the world's broadest and most-detailed studies of issues relating to the fauna of urbanized areas. Symposia on this theme have been organized by the Institute of Zoology PAS, and many scientists from home and abroad have attended them, in order to acquaint themselves with the latest research into urban fauna, and to present the results of their own studies.

In addition to these three main research topics, Professor Pisarski took up the study of the biological productivity of ants, the methods by which to research ants and issues connected with the protection of animal species. In all these studies he left distinctive traces of his own unique scientific personality.

Professor Pisarski took an active part in scientific life. He participated in numerous meetings and congresses. Amongst the most important of these were two International Entomological Congresses (Moscow 1968, Kyoto 1980). He was a member of the International Biological Programme working group on "Productivity Investigation on Social Insects and Their Role in the Ecosystems". The IBP handbook "Production Ecology of Ants and Termites" is the fruit of the labours of this international team. Professor Pisarski was also a participant at three congresses of the International Union for the Study of Social Insects (London 1973, Dijon 1975, Paris 1980).

He was a co-organizer of international meetings held in Poland. In 1970, he prepared a meeting of the IBP Working Group on Social Insects, in Warsaw. And it was there, and in Jabłonna, that the 1976 IUSI symposium on "Social Insects in the Anthropogenic Environments" took place.

Subsequent meetings of this Union were devoted to the following subjects: "Regulation of Social Insects Populations" (Skierniewice 1981); "Ecology and Importance of Social Insects in Forest Ecosystems" (Łopuszna 1989) and "Rules and Constraints of Community Assembly in Social Insects" (Szeged, Hungary, 1992). Death intervened to prevent him from participating in this last meeting.

In 1978, Professor Pisarski was co-organizer of another meeting devoted to the homeostasis of land ecosystems. To celebrate the 60th anniversary of the Institute of Zoology, PAS in 1979, he organized (again in Warsaw and Jabłonna) a symposium entitled "Animals in Urban Environments". The cycle of meetings on the situation of urban faunas is closed by the symposium on "The General Problems of Synanthropization", which he co-organized at Białowieża in 1980. As a rule, the results of these meetings are published either as separate books or as volumes of *Memorabilia Zoologica*.

In connection with his activities in the Polish Entomological Society, Professor Pisarski was for a number of years a member of the International Committee for the Organization of Symposia on the Entomofaunistics of Central Europe.

Areas outside Poland played a considerable role in Professor Pisarski's research activities. Between 1956 and 1960 he carried out systematic and faunistic research in Hungary, Romania, Bulgaria, and the states of the Caucasus. From 1959 to 1970, he made expeditions to the countries of the Far East, where he collected material in Indonesia, Vietnam, Korea, and Mongolia. Amongst all his foreign expeditions, a particular place is taken by Finland, where he carried out field research almost annually after 1978. This was based at the Zoological Station at Tvärminne as well as at the laboratories of the University of Helsinki. It was there that, in co-operation with his Finnish colleagues, he did work on the colonization of islands, geographical gradients in the distribution of ants and ant genetics. His close co-worker there was Dr. K. Vepsäläinen, a friend of the Institute of Zoology, PAS.

As part of his research into ant systematics, Professor Pisarski completed internships in museums in Budapest, Leningrad, Moscow, and Berlin.

Professor Pisarski was involved in organizational work from the beginning of his time in the Institute of Zoology, PAS. He was the head of the Hymenopterological Laboratory from 1955 to 1972. He organized the Research Team on the Fauna of the Carpathians, which carried out faunistic research and investigation into colonies of *Formica exsecta* between 1967 and 1971. He was the head of the Department of Zoocoenology between 1976 and 1980, and the Director of the Institute from 1982 to 1992.

In this period he had a major role in the co-ordination of scientific research. Between 1976 and 1980 he implemented the study "The influence of settlement pressure on fauna". From 1981 he headed the group studying "The structure of the fauna of Poland" and from 1982 to 1990 he was also in charge of the whole question of "The structure and genesis of the fauna of Poland against the background of the faunas of other areas".

He sat on numerous collegiate bodies. He was the secretary of the Scientific Council of the Institute of Zoology, PAS (1975–1981), and a member of teams co-ordinating work on crucial problems. He was a member of the committees of the Polish Academy of Sciences concerning Ecology and the Protection of Nature. In the former, he headed the Commission on Urban Ecology. From 1956, he was a member of the Polish Zoological Society and the Polish Entomological Society. In the former he was a Branch Secretary and later the Secretary of the Board of Directors; in the latter he headed the Section of Social Insects from 1971. In this period he organized several national and international symposia.

Professor Pisarski was involved in much editorial work. He was a member of the Editorial Committees of *Annales Zoologici* and *Fragmenta Faunistica* (1975–1977), and was deputy chief editor of the *Key for the Identification of the Insects of Poland* between 1975 and 1980. He headed the Editorial Board of *Memorabilia Zoologica* between 1978 and 1992 and was also the chief editor of this journal from 1982 onwards. He also helped initiate many monothematic collective works, which he later edited. These appeared in a number of volumes of the aforementioned serial editions. Some issues relating to the fauna of cities and towns were published as separate books.

Professor Pisarski's didactic activities included the supervision of scientific work. For a number of years he co-operated with the Institute of Zoology of the Warsaw

University, where he supervised 11 Master's theses. In the Institute of Zoology, PAS he supervised four doctoral dissertations and his school includes a much greater circle of people whose research work was under the influence of the concepts he developed.

His work was honoured with awards and diplomas on many occasions. In 1978, he was awarded the 35th anniversary medal of the Polish Academy of Sciences. A year later, he received the Gold Cross of Merit. His scientific work was evaluated very highly in the Warsaw scientific community. In 1983 he was chosen to be a correspondent member of the Warsaw Scientific Society and in 1987 he was nominated as an ordinary member of this Society.

For all of us he was a good colleague, who was reliable in the various difficult situations which arise during professional work in the field and in the laboratory. Kindly and tactful, he was always interested in the work of his colleagues. He is irreplaceable in scientific discussions. He left us suddenly, leaving a great emptiness behind him.

Johan BILLEN, Eric SCHOETERS

Morphology and ultrastructure of the mandibular gland in *Formica* (Hymenoptera, Formicidae)

PRZEMYSŁAW TROJAN

Abstract. The structural organization of the mandibular gland in *Formica* L. ants is described. The gland consists of a reservoir sac and a cluster of secretory cells. Together with their accompanying duct cells, the reservoir sac and duct cells were characterized more thoroughly by scanning SEM revealed the opening of the gland to be located dorsally, the reservoir sac below or the upper surface. The secretory cells are characterized by numerous microvilli, a large well-developed Golgi apparatus and very conspicuous mitochondria of the peripheral cell membrane. The duct cells are rather short, the wide being the reservoir sac distended and contain few cytoplasmic organelles.

INTRODUCTION

Among the numerous exocrine glands that govern the physiological communication system in the social Hymenoptera, the mandibular gland is the most widespread and most common in its appearance. It is found in males, workers and queens. The function of the mandibular gland secretion in one or the other way is always related with social communication. In bumblebee males, it is used for marking of their flight paths in the mating period (FRANK 1941), while in the honey bee queen it is the source of the well known queen substance (BUTLER, SIMPSON 1958). The mandibular gland in workers is mostly involved in the alarm-defense system, as was demonstrated for ants, bees and wasps (MASCOWITZ 1964).

Morphologically, the mandibular gland is composed of a more or less extensive reservoir sac and a varying number of secretory cells, that open into the reservoir by means of individual duct cells. The reservoir sac diameter gradually decreases in its proximal part to become a relatively narrow duct that eventually opens at the mesal side of the mandible. Ultrastructural data for the mandibular gland in social Hymenoptera are available for bumblebee males (STEIN 1962), workers of the stingless bee *Leptotrigona lineata* SMITH (CRUZ-LANDIM, CAMARGO 1970), for honey bee workers and drones (COSTA LEONARDO 1981, LENSKY et al. 1985), and for the formicine ant *Camponotus rufipes* FABR. (GAMBERINI 1985). Apart from the latter report, morphological

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