

Additional new data proving that early publications on the polymorphism of the spittlebug of the genus *Philaenus* were lacking in systematics

Sakis DROSPOULOS¹, Anna MARYAŃSKA-NADACHOWSKA², Valentina G. KUZNETSOVA³

¹Department of Agricultural Biotechnology, Agricultural University, Votanicos, Athens, Greece

²Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Krakow, Poland

³Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia

Abstract

In this comprehensive paper the importance of species is emphasized. It is demonstrated that careful biosystematic studies on the two species of the genus *Philaenus* known until recently, increased the number of species up to eight so far. These discoveries appear to be fundamental in explaining the expression, role, and evolution of polymorphism in this genus.

Key words: spittlebug, biosystematics, speciation, polymorphism.

Introduction

The spittlebug *Philaenus spumarius* (L.) has been known as one of the most polymorphic species of insects and more than thousand publications have referred to this phenomenon over the last century. However, much less attention was paid to the other congeneric species, *Philaenus signatus* Melichar 1896, distributed in the whole Mediterranean area and further east of it. As a result, taxonomists were not interested in this apparently simple and clear genus and geneticists reported that the two species shared the same dorsal polymorphism and number of colour morphs (Halkka and Lallukka, 1969). The expression of polymorphism was a matter of a long standing debate between several authors, mainly O. Halkka and his students from Helsinki, A. Stewart and D. Lees from Great Britain and V. Thompson from Canada. In brief, these researchers and several others reported that the expression of the dorsal polymorphism was to be attributed to the food plant of the polyphagous *P. spumarius*, to clines of some colour morphs (e.g. Halkka and Halkka, 1990), to latitude and altitude (Boucelham *et al.*, 1988), to urban effects (e.g. Stewart and Lees, 1996) and thermal effects (e.g. Thompson, 1973).

The first author has attended many of the debates of these authors but was never involved in any research on the polymorphism of species of this genus until biosystematic and faunistic research started in Greece, as a result of which a new species (*Philaenus loukasi* Drosopoulos *et* Ashe) was discovered, occurring only above 1200 m and feeding surprisingly on one plant species: *Eryngium* sp. (Drosopoulos and Ashe, 1991). The discovery of this new species and the fact that *P. signatus* was discovered to be also monophagous, surprisingly on *Asphodelus microcarpus*, prompted the first author to study the polymorphism of this fascinating genus under a new approach. In this abstract reference is made only to the paper of Drosopoulos (2003) where the reader can find clearly how and where the number of

Philaenus species increased from two to eight, so far. These species are: *P. spumarius* described from Sweden; *Philaenus tessellatus* Melichar 1889, distributed in the south of the Iberian Peninsula and northwestern Africa, taken out of synonymy of *P. spumarius*; *P. loukasi*; *Philaenus arslani* Abdul-Nour *et* Lahoud 1995, from Lebanon; *Philaenus tarifa* Remane *et* Drosopoulos 2001, very locally in South Spain, *P. signatus* limited to the East Mediterranean region, *Philaenus italosignus* Drosopoulos *et* Remane 2000, distributed in southern Italy and Sicily and *Philaenus maghresignus* Drosopoulos *et* Remane 2000, distributed in the southern Iberian peninsula and north-western Africa (mainly Morocco). All these species can be distinguished morphologically mainly by their size and characters of the male genital segment, but some of them by only by their colour morphs. Thus, polymorphism is specific in most species groups, but certain colour morphs are specific or some of them are lacking so far in some species, despite the plant species each of them feeds on.

All these new findings reported here very briefly created a new start in many aspects of the biology, speciation and evolution of polymorphism. At that state the first author was interested in finding colleagues for further studies on this newly arisen and unique species complex. Recently this desire was shared by two laboratories of the Polish and the Russian Academies of Sciences and the Agricultural University of Athens, performing molecular techniques and cytogenetics and the newly collected material of the *Philaenus* species used also for further studies on the polymorphism. The studies in the field were focused on collecting material of *Philaenus* on the lily *A. microcarpus* before the spittlebug migrated to the shrubs or trees in Iberian (May 2005) and Apennine (May 2006) peninsulas from where limited material was previously available.

These studies have shown among other interesting topics on the phylogeny of the eight species, that polymorphism in *P. signatus* species group is unique in *P. italosignus* from South Italy, especially from Sicily.

There, in some localities all colour types in males and females (seven and eight respectively) were melanic and it was difficult to separate three of them, especially *typicus* (TYP), *flavicollis* (FLA), and *quadripunctatus* (QUA). Quite surprising, only there, also the morph *trilineatus* (TRI) of *P. italosignus* was found in both sexes. But the most fascinating was the presence of the colour morphs FLA, *leucophthalmus* (LOP), *leucocephalus* (LCE) and QUA also in both sexes. These new data will be published soon and will be related to all other aspects of their biology.

All these data collected so far strongly support the theory of the first author that speciation and polymorphism in this species complex have their origin in the Mediterranean basin.

Acknowledgements

These investigations combining hard field work in the northern Mediterranean and analyses in the laboratories could not have been made without the support of the Ministry of Science and Higher Education of Poland (grant number 303 01731/0639). We are very grateful to Adam Nadachowski for invaluable help in fieldwork. Worth mentioning here is the success of him and the second author in collecting all members of the *P. signatus* species group, even (for the second time) *P. tarifa* and for the first time on the lily.

References

- BOUCELHAM M., HOKKAINEN H., RAATIKAINEN M., 1988.- Polymorphism of *Philaenus spumarius* (L.) (Homoptera, Cercopidae) in different latitudes, altitudes and habitats in the U.S.A.- *Annales Entomologicae Fennicae*, 54: 49-54.
- DROSOPOULOS S., 2003.- New data on the nature and origin of colour polymorphism in the spittlebug genus *Philaenus* (Hemiptera: Aphrophoridae).- *Annales de la Société entomologique de France*, 39: 31-42.
- DROSOPOULOS S., ASCHE M., 1991.- Biosystematic studies on the spittlebug genus *Philaenus* with the description of a new species.- *Zoological Journal of the Linnean Society*, 101: 169-177.
- HALKKA O., HALKKA L., 1990.- Population genetics of the polymorphic spittlebug *Philaenus spumarius* (L.), pp. 149-191. In: *Evolutionary Biology* (HECHT M. K., WALLACE B., MACYNTIRE R. J., Eds) vol. 24.- Plenum Press, New York, USA.
- HALKKA O., LALLUKKA R., 1969.- The origin of balanced polymorphism in the spittlebugs (*Philaenus*, Homoptera).- *Annales Entomologicae Fennicae*, 6: 431-434.
- STEWART A. J. A., LEES D. R., 1996.- The colour pattern polymorphism of *Philaenus spumarius* (L.) (Homoptera: Cercopidae) in England and Wales.- *Philosophical Transactions of the Royal Society of London B*, 351: 69-89.
- THOMPSON V., 1973.- Spittlebug polymorphic for warning coloration.- *Nature*, 242: 126-128.

Corresponding author: Sakis DROSOPOULOS (e-mail: drosop@aua.gr), Department of Agricultural Biotechnology, Agricultural University, Iera Odos 75, 11855 Votanicos, Athens, Greece.