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The karyotypes of Procridinae (Lepidoptera: Zygaenidae), with the first record of the karyotype of *Pollanisus commoni* Tarmann, 2004, a representative of the tribe Artonini

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Synopsis

An overview of all known karyotypes of Procridinae is provided. The hitherto unknown haploid chromosome number (31) is determined for *Pollanisus commoni* Tarmann, 2004.

Key words: Lepidoptera, Zygaenidae, Procridinae, Artonini, *Pollanisus commoni*, haploid chromosome numbers.

Introduction

The Procridinae are a unique group within the Zygaenidae from a karyological point of view and investigation of the karyotypes is very important for the understanding of evolutionary relationships and the systematic position of species in this subfamily (Efetov, 2004).

During the past few years the karyotypes of several species of the subfamilies Zygaeninae, Chalcosiinae and Procridinae (Zygaenidae), from the genera *Zygaena* Fabricius, 1775, *Aglaope* Latreille, 1809, *Theresimima* Strand, 1917, *Rhagades* Wallengren, 1863, *Illiberis* Walker, 1854, *Adscita* Retzius, 1783, and *Jordanita* Verity, 1946, have been studied (Efetov, 1998; 2001*a*; 2001*b*; 2004; Efetov & Tarmann, 1999; Efetov, Parshkova & Tarmann, 2003; Efetov, Parshkova & Koshio, 2004; Efetov & Parshkova, 2004; 2005).

In the subfamily Zygaeninae the haploid chromosome number in the majority of the studied species is 30 (Lukhtanov & Kuznetsova, 1988; Tremewan, 2002; 2006; Efetov & Parshkova, 2003; 2004) whereas the Procridinae species (tribe Procridini) show a large variability of the karyotypes (haploid chromosome numbers ranging from 12 to 47) (Efetov, 2001*a*; 2001*b*; Efetov & Parshkova, 2005). Hitherto the karyotypes of species of the tribe Artonini Tarmann, 2004, were not known (Tarmann, 1994; Efetov, 1997; 2006).

Investigation of the karyotypes from further Procridinae genera may provide additional information for the understanding of their systematic position and

Table 1. The haploid number (n) of chromosomes of species of the subfamily Procridinae.

Genus	Subgenus	Species	Origin	n	First published
Pollanisus		*commoni*	Australia	**31**	this publication
Illiberis	*Primilliberis*	*rotundata*	Japan	**25**	Efetov, Parshkova & Koshio, 2004
Theresimima		*ampellophaga*	Crimea	**28**	Efetov, 1998
Rhagades	*Naufockia*	*brandti*	Iran	**31**	Efetov, Parshkova & Tarmann, 2003
	Wiegelia	*amasina*	Turkey	**12**	Efetov, 2001*a*
	Rhagades	*pruni*	Crimea	**47**	Efetov, 1998
Adscita	*Procriterna*	*subtristis*	Kyrgyzstan	**17**	Efetov, 1998
	Adscita	*jordani*	Spain	**30**	Efetov, Parshkova & Tarmann, 2003
		schmidti	Spain	**31**	Efetov, Parshkova & Tarmann, 2003
		statices	Turkey	**31**	Efetov, 2001*b*
		geryon	Crimea	**32**	Efetov, 1998
		albanica	Crimea	**31**	Efetov, 1998
	Tarmannita	*mannii*	Italy	**31**	Efetov, 1998
		bolivari	Spain	**31**	Efetov, Parshkova & Tarmann, 2003
Jordanita	*Roccia*	*budensis*	Crimea	**31**	Efetov, 1998
	Tremewania	*notata*	Crimea	**31**	Efetov, 2001*a*
	Jordanita	*graeca*	Crimea	**31**	Efetov, 1998
		chloros	Crimea	**31**	Efetov, 1998
	Solaniterna	*subsolana*	Crimea	**27**	Efetov, 2001*a*

evolutionary relationships. In this paper an overview of all known karyotypes of Procridinae is provided (Table 1).

The karyotype of a representative of the tribe Artonini, *Pollanisus commoni* Tarmann, 2004, was determined and is here recorded for the first time. Mature larvae (sixth instar) of this species were collected by B. Mollet & G. M. Tarmann on 21.iv.2013 at Port Douglas, Queensland, Australia.

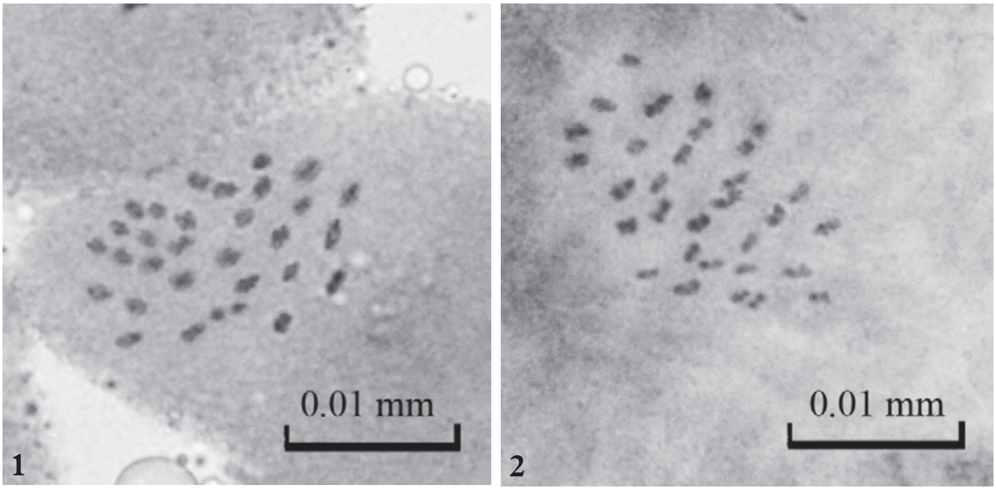
Methods

When the larvae began to spin cocoons the abdominal parts of the larvae were cut and then fixed in a solution of 1 part ethanol to 1 part glacial acetic acid. Then the material was sent to Simferopol (Crimea) for investigation. After six months of fixation the larvae were dissected. For karyological analysis only males were used. The testes were removed from the abdomens and the gonads were stained in 2% lacto-orcein for a period of 6 days. Temporary slides were prepared in a drop of 40% lactic acid by using the squash method. Permanent slides were made in Euparal. Investigation of the karyotype and calculation of the number of chromosomes was done in the metaphase stage with the help of light microscopy (OLYMPUS BX43 microscope, ×100 oil immersion objective). The images were obtained using a digital camera (OLYMPUS E-410) with the help of the computer program 'QuickPHOTO CAMERA 2.3'.

Several metaphase plates of good quality showing a haploid chromosome number n = 31 were obtained. The chromosomes represent bivalents with a comparable size (Figs 1, 2).

Discussion

The modal haploid chromosome number for Lepidoptera is generally 30–31 (Robinson, 1971; 1990; Lukhtanov & Kuznetsova, 1998). For the tribe



Figs 1, 2. *Pollanisus commoni* Tarmann, 2004. Meiotic metaphase of spermatogenesis. Haploid chromosome number: n = 31. Male specimen No. 2, preparation 381.2.

Procridini of the subfamily Procridinae, 31 is a common number (Efetov, 2004). However, in many species of this subfamily the haploid chromosome numbers differ from the modal (Table 1). In species of the subgenera *Roccia* Alberti, 1954, *Tremewania* Efetov & Tarmann, 1999, and *Jordanita* Verity, 1946 (genus *Jordanita* Verity, 1946), the haploid chromosome number is 31, while in the subgenus *Solaniterna* Efetov, 2004, it is 27. The same situation is found in the genus *Adscita* Retzius, 1783. While the majority of species of the subgenera *Adscita* Retzius, 1783, and *Tarmannita* Efetov, 2000, have the haploid chromosome number 31, in *Adscita* (*Adscita*) *jordani* (Naufock, 1921) it is 30, in *Adscita* (*Adscita*) *geryon* (Hübner, 1813) it is 32, and in the subgenus *Procriterna* Efetov & Tarmann, 2004, it is 17. The most dramatic differences in chromosome numbers were found in the genus *Rhagades* Wallengren, 1863. In the primitive species *Rh.* (*Naufockia*) *brandti* (Alberti, 1938) it is modal (31), but in *Rh.* (*Wiegelia*) *amasina* (Herrich-Schäffer, 1851) it is only 12, and in *Rh.* (*Rhagades*) *pruni* ([Denis & Schiffermüller], 1775) it is 47! We consider this increase in the number of chromosomes in *Rh. pruni* to be the result of polyploidy (Efetov, 2001*a*; 2001*b*). A hypothesis for the allopolyploid origin of high chromosome numbers in bisexual Lepidoptera was proposed by Lukhtanov & Puplesene (1999). The high chromosome number in *Rh. pruni* may have provided high adaptability for this species, thus culminating in a very wide distribution (from the Pyrenees to Japan) and polyphagy by the larva (species of the other subgenera of *Rhagades* have local areas of distribution and feed only on Rosaceae) (Efetov, 2001*a*).

It is also interesting that the number is reduced (compared with the modal) to 25 in *Illiberis* (*Primilliberis*) *rotundata* Jordan, 1907, and to 28 in *Theresimima ampellophaga* (Bayle-Barelle, 1808). This means that, with the exception of *Rh. brandti*, the modal number in the genera *Rhagades* Wallengren, 1863, *Theresimima* Strand, 1917, and *Illiberis* Walker, 1854, does not occur (Table 1).

Aglaope infausta (Linnaeus, 1767) (subfamily Chalcosiinae) has the modal haploid chromosome number 31 (Efetov, Parshkova & Tarmann, 2003).

As *Pollanisus commoni* also has 31 and the genus *Pollanisus*, according to morphology, is a basic group of the tribe Artonini, it can be concluded that this chromosome number may represent a ground type for the subfamily Procridinae.

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