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THE CHROMOSOMES OF LACHNIDAE

Roger L. Blackman

Department of Entomology, Natural History Museum, Cromwell Road, London, SW7 5BD, UK

ABSTRACT

Some features of the cytogenetics and cytotaxonomy of Lachnidae are discussed, with particular attention to differences in chromosome number between closely related species, the system of sex determination and the behaviour of the X chromosomes during spermatogenesis, and the occurrence and distribution of "B chromosomes" and constitutive heterochromatin.

INTRODUCTION

Karyotypes of more than 60 species of Lachnidae are known, of which more than 40 are Cinara species. Despite the generally large size of the aphids in this family, their chromosomes are often rather small and difficult to resolve. This is especially so in the case of Lachninae and Traminae, which mostly do not provide well-spread metaphase preparations. Nevertheless, lachnids show a number of features of cytogenetic and cytotaxonomic interest, which are described in this paper.

MATERIALS AND METHODS

Satisfactory squash preparations of somatic cell nuclei can generally be obtained from young embryos dissected out of aphids fixed directly in 3 parts methanol: 1 part glacial acetic acid, and kept for several months

Akadémiai Kiadó, Budapest

in this fixative, provided that the embryos are hydrolysed with 1N hydrochloric acid for 5 min at 65 C prior to squashing in 45% propionic acid (for details see Blackman, 1980a).

However, with Lachninae (notably Lachnus and Stomaphis) and Traminae, pretreatment of living tissue in a mildly hypotonic solution (e.g. 0.75% potassium chloride, or 1% sodium citrate) for 5-10 min prior to fixation is generally necessary in order to prevent late prophase and metaphase chromosomes from clumping together. Freshly-fixed material (left only 15-30 min in methanol/acetic acid fixative) can be squashed directly in propionic acid without prior treatment in hydrochloric acid, although acid hydrolysis will give a cleaner preparation with less cytoplasmic background.

Squashes made with freshly-fixed material can be "C-banded" to reveal constitutive heterochromatin (sections consisting mainly of highly repetitive DNA sequences). The method involves denaturation of DNA with strong alkali, followed by incubation in a saline solution that selectively renatures highly repetitive sequences (for details see Blackman, 1985).

Spermatogenesis occurs in the testes of 1st and 2nd instar males, and is virtually complete by the 3rd instar. Squash preparations of testis tissue can be made in the same way as for embryonic cells.

RESULTS AND DISCUSSION

Lachninae Somatic cell chromosomes of Stomaphis and Lachnus are particularly difficult to resolve, which is a pity because their karyotypes are potentially useful as taxonomic characters. Most European populations of Stomaphis quercus (L.) examined, collected from both Quercus and Betula,have a 2n(female)=10 karyotype like that of S. japonicus Takahashi (Fig. 1b). A sample from Quercus petraea in Czechoslovakia, however, had 2n=8 (Fig. 1a), lacking the the two smallest chromosomes. By analogy with

S. japonicus (see below), the missing elements are probably X chromosomes, although X chromosome numbers are usually very stable in aphids. S. cupressi (Pintera) is very different with 2n=14 (Fig. 1c), and S. yanonis Takahashi has 2n=?16 (but Honda, 1921, recorded a haploid number of 10 for yanonis).

Karyotype	Provenance of samples
2n= 7?	Q. robur, W. Germany (2 samples)
2n= 8 (7+1B)	Q. cerris, Czechoslovakia; Q. robur, W. Germany (2)
2n= 9 (7+2B)	Q. robur, Czechoslovakia, Denmark, Poland
2n=10	Castanea sativa, Portugal, ?UK
2n=11 (10+1B)	Q. robur, Sweden (1), UK (4)
2n=12?	Q. borealis, Portugal
2n=14	Castanea sativa, ?UK; Q. robur, UK
2n=15 (13+2B?)	Q. pyrenaica, Q. suber; both Portugal
2n=16	Q. ilex, Portugal (2)
2n=17?	Q. ilex, Portugal

Table 1 Karyotype variation in the Lachnus roboris group (23 samples) (uncertain karyotype determinations are indicated by "?")

Lachnus roboris (L.) (Fig. 1d-f) shows great variation in chromosome number, some of which may be intraspecific and due to variable numbers of accessory heterochromosomes ("B chromosomes"). Table 1 summarises the available data and shows the difficulty of demonstrating any particular association between karyotype and host plant. A more intensive study, integrating karyotypic data with biological, morphometric and possibly enzyme/DNA studies, is needed to clarify the taxonomy of these aphids. L. tropicalis (van der Goot) in Japan and China shows similar variability (2n=12, 13 and 16 in 6 samples). One sample of L. iliciphilus (del Guercio) from West Germany had 2n=8.