

Triploid pseudogamous biotype of the leafhopper *Muellerianella fairmairei*

THE sibling leafhopper species *Muellerianella fairmairei* (Perris, 1857) and *M. brevipennis* (Boheman, 1847) (Homoptera, Delphacidae) are widely sympatric in Europe. Studies of the biological differences between the two species, and of their hybridisation has revealed a remarkably high proportion of females of *M. fairmairei* sampled in the field and a gradual disappearance of males in laboratory colonies. *M. brevipennis* had a normal sex ratio in field samples and when reared in the laboratory¹. Additional cytogenetic studies now demonstrate that in *M. fairmairei* a pseudogamous female triploid biotype coexists with the diploid bisexual form.

Populations of *M. fairmairei* (Southern Greece and Southern France) and *M. brevipennis* (Holland), which maintain a 1:1 sex ratio are diploid ($2n = 28$). In both species the male karyotype consists of thirteen autosome pairs and one XY pair ($2n = 13 \text{ AII} + \text{XY}$). The female karyotype (Fig. 1a and b) shows thirteen autosome pairs and a large pair of XX chromosomes ($2n = 13 \text{ AII} + \text{XX}$).

Populations of *M. fairmairei* from Holland (Leersum) and England (Ascot–Silwood Park) with a high proportion (75–100%) of females seemed to comprise diploid males and a mixture of diploid and triploid females. Somatic metaphases of the triploid females, as far as could be determined, consistently had 41 chromosomes, including three X chromosomes. Ovarian semi-mature and mature eggs always contained a metaphase plate with 41 “pseudobivalents” (Fig. 1c). Their size was approximately half that of the bivalents of the diploid female, and they resembled secondary oocyte chromosomes. In this insect the first and second meiotic divisions probably do not take place and are replaced by a single equational division.

After the triploid biotype of *M. fairmairei* had been isolated in the laboratory, three experimental crosses were made to investigate the role of the sperm in the production of triploid females. When the cross was *M. fairmairei* ($3n$) ♀♀ × *M. fairmairei* ♂♂, five pairs reared on their host plant, *Holcus lanatus* (L.) produced triploid females only and in high numbers (160–514) females per pair. All five females appeared to have mobile sperm in their spermathecae. When the cross was *M. fairmairei* ($3n$) ♀♀ × *M. brevipennis* ♂♂, six pairs placed in a cage containing *H. lanatus* and *Deschampsia caespitosa* (L.) (the latter is the specific food plant of *M. brevipennis*) produced comparatively few triploid females (a total of 88). Three of the six crossed females had mobile sperm in their spermathecae. When the cross was *M. fairmairei* ($3n$) ♀♀ × sterile hybrid ♂♂, nine sterile males (produced by previous crossing of *M. brevipennis* ($2n$) ♀♀ × *M. fairmairei* ♂♂) were paired with females in glass tubes containing *H. lanatus*. Although the triploid females were observed several times copulating with the hybrid males, none of the 163 eggs deposited exhibited embryogenesis.

Thus the triploid biotype of *M. fairmairei*, which is morphologically indistinguishable from the diploid female, has a typically pseudogamous mode of reproduction. The entrance of sperm (derived from the males of *M. fairmairei* or the closely related *M. brevipennis*) is necessary for embryonic development to occur, but the sperm probably do not fuse with the egg nucleus. Copulation with sterile males is ineffective. So far this mode of reproduction has not been reported in Hemiptera², although other forms of parthenogenesis are well known in this order.

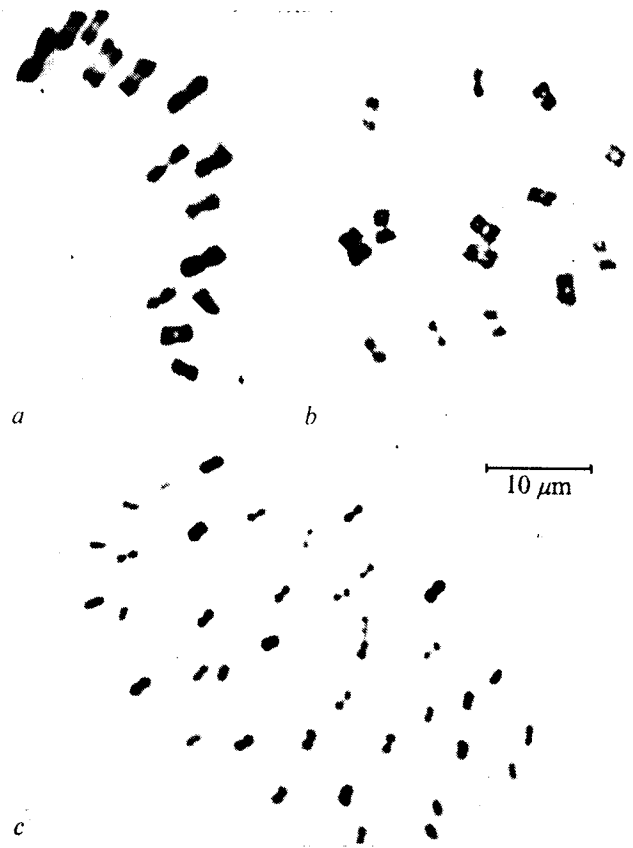


Fig. 1 The chromosome complements of *M. fairmairei* ($2n$): a, *M. brevipennis*; b, *M. fairmairei* ($3n$); c, at the first female meiotic division, which occurs in the nucleus of semi-mature eggs. The bar in (c) represents 10 μm . All photomicrographs are reproduced at the same magnification.

When both female biotypes of *M. fairmairei* were reared together in the presence of males, the diploid type disappeared after one or two generations. The higher fecundity of the pseudogamous biotype and the fact that it produces all-female progeny possibly explain this phenomenon. It is not known how both biotypes can coexist in the field. It is clear, however, that the triploid type requires the availability of a diploid population for its maintenance.

An indication that the triploid biotype might be of hybrid origin is its ability to oviposit and develop on *D. caespitosa*, the host plant of *M. brevipennis*. Diploid hybrids, originated from crosses of *M. fairmairei* ($2n$) ♀♀ × *M. brevipennis* ♂♂ and the reciprocal cross, have the same ability. Also, the meiotic behaviour of some female diploid hybrids (28 “pseudobivalents”) closely resembles that of the triploid.

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¹ Drosopoulos, S., *Ent. Berichten*, 35, 154–157 (1975).

² White, M. J. D., *Animal Cytology and Evolution*, 961 (Cambridge University Press, Cambridge, 1973).