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G-BANDING ANALYSES OF MALE CHROMOSOMES IN *APIS CERANA AND A. MELLIFERA LIGUSTICA*

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SUMMARY

Karyotype and G-banding patterns in the somatic division of *Apis cerana japonica* were compared with *A. mellifera* in this paper.

Sixteen chromosomes of this species were divided into two groups, metacentric (nos. 1-4) and submetacentric (nos. 5-16), same as in *A. mellifera*. The cyto-taxonomical difference between these two species was established by the region less reactive to Giemsa staining. This was in the shorter arm of chromosome no. 2, supposedly the nucleolus organizing region. The G-banding patterns were almost the same in the both species.

INTRODUCTION

Recent cytological studies of the honeybee made clear that the chromosome number of the genus *Apis* was 16 in haploid males (FARENFORST, 1977). The chromosome number of diploid males and female was counted in *A. mellifera* (HOSHIBA, 1979), and in *A. cerana japonica* (HOSHIBA *et al.*, 1981).

The detailed karyological and banding analyses of *A. mellifera* were proposed in the haploid male (HOSHIBA, 1984 a) and the diploid male and the female (HOSHIBA, 1984 b).

There have been some biometric (OKADA *et al.*, 1956 ; MORIMOTO, 1965, 1968 ; RUTTNER, 1978 ; CHOI, 1985), chemical (TANABE *et al.*, 1970), genetic (RUTTNER and MAUL, 1983) and cytological (DEODIKAR and THAKAR, 1966 ; FAHRENHORST, 1977) data on the taxonomic or evolutionary relationships between *A. cerana* and *A. mellifera*. No interspecific differences have been found in the karyological studies.

The distinct karyological and G-banding analyses of the haploid male of *A. cerana japonica*, compared with *A. mellifera*, are presented in this paper from the cytotaxonomic point of view.

MATERIALS AND METHODS

Young male larvae (3-4 instar) of *A. cerana japonica*, and *A. mellifera ligustica*, a mixed strain widely distributed in Japan were dissected to obtain the testes. These testes were pretreated in a hypotonic solution (0.4 % KCl, 0.01 % colchicin) for 30 min, fixed in acetic acid-methanol (1 : 3) and stored at about — 20 °C.

The preparations were made by the usual air dry method (TAKAGI, 1971), and stained with Giemsa solution. They were then decolored by means of acetic methanol. The tripsin method (SEABRIGHT, 1971) was used to determine the G-banding.

RESULTS AND DISCUSSION

The chromosome number of the haploid set of *A. cerana japonica* was 16. This set consists of 4 metacentric nos, 1-4), 12 submeta- or subtelocentric chromosomes (Fig. 1). The G-banding karyotype pattern of *A. cerana japonica* and *A. mellifera* are illustrated in Fig. 1 and 2, respectively. As HOSHIBA *et al.* (1981) mentioned, the karyotype and the G-banding pattern were similar to those of *A. mellifera* except for chromosome no. 2. Especially in the early meta-

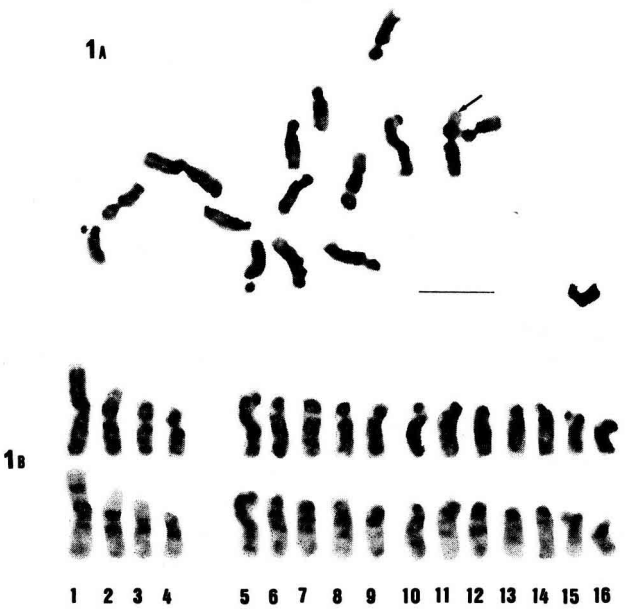

FIG. 1. — *Mitotic metaphase chromosome of* Apis cerana japonica *(A) and its G-banding karyotype pattern (B)*

The less reactive region to Giemsa staining was observed (arrow) in the no. 2 chromosome of this species. Bar indicates 5 μm.

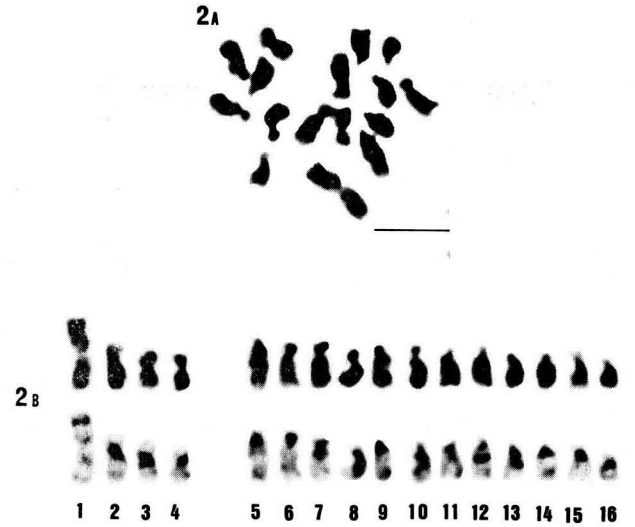

FIG. 2. — *Mitotic metaphase chromosomes of* Apis mellifera *(A) and its G-banding karyotype pattern (B)*

Bar indicates 5 μm.

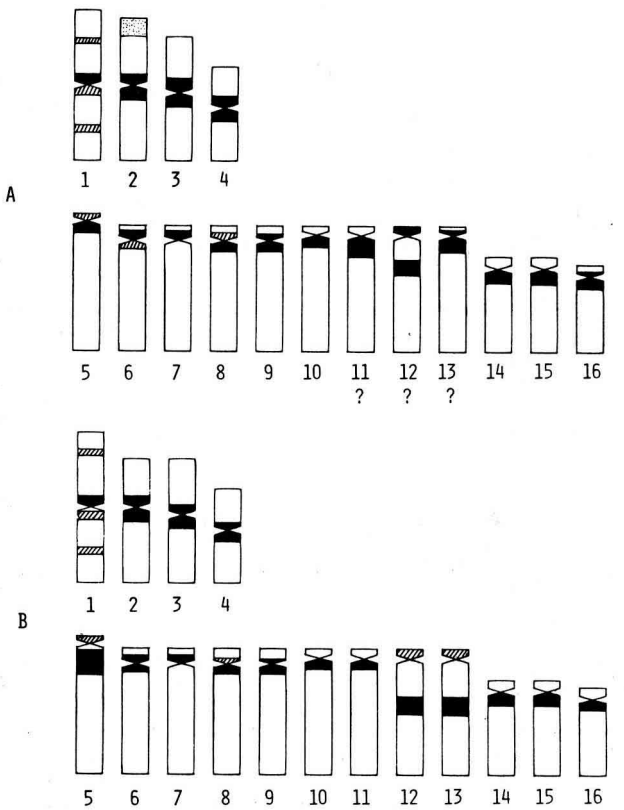

FIG. 3. — *Schematic G-banding pattern of* Apis cerana japonica *(A) and* Apis mellifera *(B)*

phase cell, no. 2 in *A. cerana japonica* was characterized by a region less reactive to Giemsa staibning in the shorter arm. This is supposed to be a nucleolus organizing region. This region has not been found in *A. mellifera* so far studied. Thus, the cytotaxonomical difference between *A. mellifera* and *A. cerana* was established. However, the karyotype analyses of the other local sub-species of *A. cerana* in Asia, and other analyses such as C- or NOR-banding methods are required for further investigation. The G-banding pattern of each chromosome was almost the same in the two species, except for the occurrence of some undetermined chromosomes in *A. cerana japonica* (Fig. 3 b). WOYKE (1973), RUTTNER and MAUL (1983) and HOSHIBA, unpublished) instrumentally inseminated between these species. The only embryological investigation of hybrids was made by RUTTNER and MAUL (1983), they found that eggs laid by intercrossed queens developed into an embryonic stage, *i.e.*, each chromosome must be paired for a certain period. There have been no examples of successful hybrid production by natural matings in Japan, where both species exist, in spite of some successful examples (HACHINOHE, personal communication, 1985) by instrumental insemination and by natural mating (VATS, 1953). Attempts to make hybrid are difficult from the karyo-morphological view point.

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ZUSAMMENFASSUNG

G-BANDEN ANALYSE DER MÄNNLICHEN CHROMOSOMEN VON *APIS CERANA* UND *A. MELLIFERA LIGUSTICA*

Karyotyp und G-Banden Muster bei der somatischen Teilung von *Apis cerana japonica* wurden mit denen von *A. mellifera* verglichen.

Die 16 Chromosomen dieser Art können in zwei Gruppen eingeteilt werden, metazentrische (Nr. 1-4) und submetazentrische (Nr. 5-16), genau so wie bei *A. mellifera*. Die cyto-taxonomische Differenz zwischen den beiden Arten manifestiert sich in einer Region, die weniger gut auf die Giemsa Färbung anspricht. Sie liegt im kürzeren Arm des Chromosoms Nr. 2 und ist wahrscheinlich der Nucleolenbildungsort. Die G-Banden Muster der beiden Arten sind ziemlich gleich.

RÉSUMÉ

ANALYSE DES BANDES G DES CHROMOSOMES DES MÂLES D'*APIS CERANA JAPONICA* ET D'*A. MELLIFICA LIGUSTICA*

On a comparé le caryotype et le spectre des bandes G lors de la division somatique chez *Apis cerana japonica* et *A. mellifica ligustica*.

Chez les deux espèces, les 16 chromosomes peuvent être séparés en 2 groupes, l'un métacentrique (n° 1-4), l'autre submétacentrique (n° 5-16). La différence cyto-taxonomique entre les 2 espèces se manifeste par une région qui réagit moins bien à la coloration de Giemsa. Elle est située dans le bras le plus court du chromosome n° 2 et supposée être le lieu de formation du nucléole. Les spectres des bandes G sont presque semblables chez les 2 espèces.

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