Genetica 74: 69–71, 1987

A cytogenetic study of four species of cockatoos and Amazon parrots

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Received 27.6.1986 Accepted in revised form 2.12.1986

Abstract

The karyotypes of three species of cockatoos, *Cacatua moluccensis, Cacatua goffini*, and *Cacatua sanguinea*, and one Amazon parrot, *Amazona aestiva*, are described for the first time. These karyotypes are compared to the twenty-three species of psittacines published previously. *Cacatua moluccensis* appears to be a link in the evolutionary tree between *Probosciger aterrimus* and the other cockatoo species studied. This study reaffirms that the cockatoos are probably most closely related to the loris (*Loriculus* sp.) and Amazon parrots based on karyotype (M. W. M. Van Dongen & L. E. M. De Boer, (Genetica 65: 109–117) 1984).

Introduction

The karyotypes of twenty-three species of the order Psittaciformes have been previously described (for review see Van Dongen & De Boer, 1984; De Lucca, 1984). The classification of this complex order of birds still remains somewhat controversial (Forshaw, 1977). The study of karyotypes adds to the information base upon which this classification can be clarified.

Material and methods

All parrots studied were brought in to the Veterinary Teaching Hospital of the Western College of Veterinary Medicine for examination or surgical sexing purposes. These included 1 salmon-creasted cockatoo (*Cacatua moluccensis*), 6 Goffin's cockatoos (*Cacatua goffini*), 2 little corella cockatoos (*Cacatua sanguinea*), and 2 blue-fronted Amazon parrots (*Amazona aestiva*). The species identification was based on owner information combined with measurements for verification when necessary using those of Forshaw (1977) for comparison. Blood was drawn using heparinized syringes from the brachial vein.

Chromosomes were prepared using 0.5 ml of whole blood in 7 ml of Ham's F10 medium with Hepes buffer (Gibco) containing 25% fetal calf serum and gentamycin to which 0.10 ml of pokeweed mitogen (Sigma) was added. A second 0.15 ml of pokeweed was added after 24 h (Van Dongen & De Boer, 1984). Cultures were incubated at 40 °C for 72 hours and harvested in the usual manner.

Results and discussion

The mitotic index on all psittacines studied was low compared with some other species of birds studied in our laboratory, particularly geese and chickens. Phytohaemaglutinin caused excessive red cell agglutination and therefore pokeweed was found to be a preferable mitogen in these species. The use of plasma rather than whole blood was difficult with the small blood samples obtained and did not improve the mitotic index.

The cockatoos

The eight pairs of macrochromosomes of the 3 cockatoo species studied are presented in Figure 1. The diploid number of *C. moluccensis* is 76, of *C. goffini* is 74, and of *C. sanguinea* is 74.

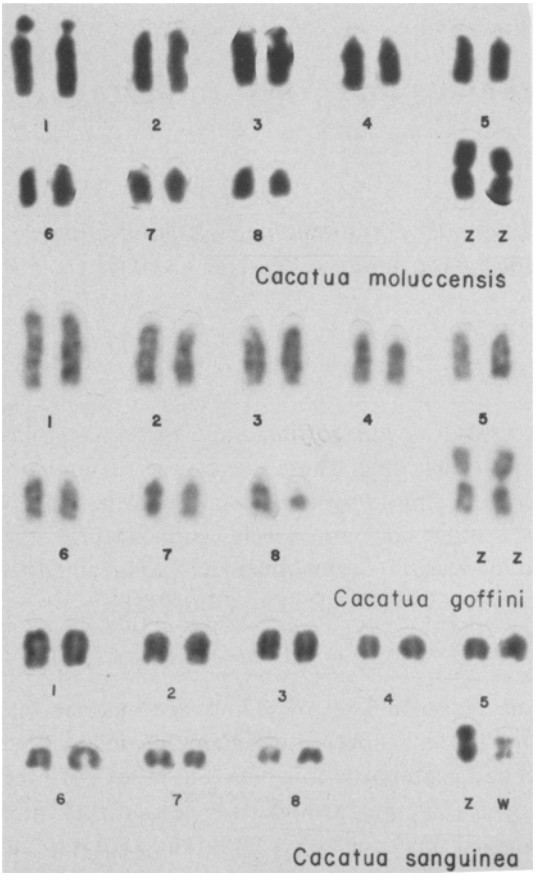

Fig. 1. Partial karyotypes of the moluccan (*Cacatua moluccensis*), Goffin's (*C. goffini*), and little corella cockatoos (*C. sanguinea*).

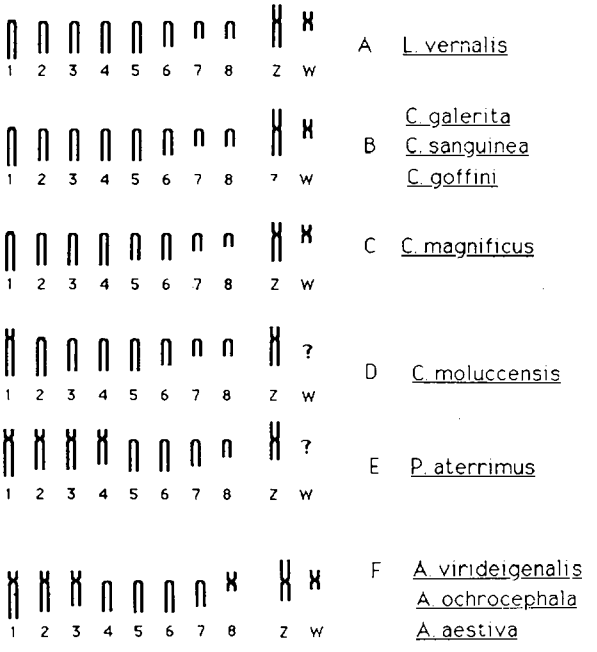

Fig. 2. Idiograms of the macrochromosomes of the lori (A), cockatoos (B–E), and Amazon parrots (F, G) studied to date.

The karyotypes of three members of this family have been studied previously (Van Dongen & De Boer, 1984). In both *C. goffini* and *C. sanguinea*, the autosomes were all acrocentric as they were in the sulphur-crested cockatoo (*C. galerita*) and the black cockatoo (*C. magnificus*) (Van Dongen & De Boer, 1984) (Fig. 2B & C). The karyotype of the salmon-crested cockatoo differs from the previous four cockatoos in that the first pair of chromosomes is submetacentric rather than acrocentric (Fig. 2D). The karyotype of the palm cockatoo (*Probosciger aterrimus*) (Fig. 2E) appears to contain 4 submetacentric autosomal pairs with all others acrocentric (Van Dongen & De Boer, 1984).

The Z chromosomes of five of the six species is a large metacentric chromosome. In the case of *C. magnificus* (Van Dongen & De Boer, 1984), it appears to be submetacentric. The W chromosome of the previously reported species and the corella (*C. sanguinea*) are small metacentric chromosomes. Female salmon-crested (*C. moluccensis*) and Goffin's cockatoos (*C. goffini*) were not karyotyped.

The Amazon parrots

The macrochromosomes of the blue-fronted Amazon parrot (*A. aestiva*) are shown in Figure 3. They

Fig. 3. Partial karyotype of the blue-fronted Amazon parrot (*Amazona aestiva*).

consist of 3 large submetacentric pairs, 4 medium-sized acrocentric pairs, and 1 small metacentric pair. The diploid number is 68. The Z is a large metacentric chromosome and the W a small metacentric, slightly larger than the no. 8 chromosomes.

Two species of Amazon parrots, the yellow headed Amazon (*Amazona ochrocephala*) (De Boer & Belterman, 1980) and the blunt-tailed Amazon (*A. viridigenalis*) (Van Dongen & De Boer, 1984) have been previously described. All three Amazon species have similar macrochromosome and sex chromosome pairs (Fig. 2F).

Taxonomic relationships

Van Dongen & De Boer (1984) conclude that the cockatoos may be most closely related to the loris (*Loriculus* sp.) and Amazon parrots. The karyotypes of three more cockatoos and one Amazon parrot of this study add further evidence to this hypothesis. The karyotype of the Goffin's, little corella, and sulphur-crested cockatoos closely resemble that of *Loriculus vernalis* (Ray-Chaudhuri *et al.*, 1969).

The karyotype of the salmon-crested cockatoo in this study possibly provides a link in the evolutionary tree between the palm cockatoo and the other cockatoos previously studied since it shows one submetacentric autosome pair *versus* four pairs in *Probosciger aterrimus* and none in the other cockatoos.

Acknowledgements

We express our gratitude to the psittacine owners for allowing us to study their birds. Our thanks to the Department of Herd Medicine and Theriogenology for allowing us to use their tissue culture facility. We thank the Companion Animal Health Fund of the Western College of Veterinary Medicine for financial support.

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