

¹Institut National de la Recherche Agronomique, Laboratoire du Cytogénétique, Centre de Recherches de Jouy, 78350 Jouy-en-Josas, France; ²Ecole des Hautes Etudes en Sciences Sociales, 44, rue de la Tour, 75016 Paris, France.

A Cytogenetic Investigation of Madura Cattle

C.P. Popescu¹ and W.G. Smith²

Contents: „Madura cattle,“ the variety found on the Indonesian island of Madura, is most often referred to as a cross between *Bos javanicus* and *Bos indicus*, based largely on phenotypic appearance. The karyotypic patterns of Madura cattle resemble those of *Bos taurus*, with the exception of the Y chromosome, which is of *Bos indicus* type. Based on what is known of *Bos javanicus*, it is concluded that Madura cattle could be the result of a cross between a *Bos taurus* or *Bos javanicus* cow and a *Bos indicus* bull.

Key words: chromosomal analysis, tropical breeds cattle

Inhalt: Eine cytogenetische Untersuchung über das Madura-Rind

Das Madura-Rind, eine Varietät der indonesischen Insel Madura, wird wegen seines Aussehens oft als Kreuzung zwischen *Bos javanicus* (Banteng) und *Bos indicus* (Zebu) angesehen. Das karyotypische Bild des Madura-Rindes gleicht jenem von *Bos taurus* mit Ausnahme des Y-Chromosoms, welches dem *Bos indicus*-Typ entspricht. Nachdem, was über *Bos javanicus* bekannt ist, muß man folgern, daß das Madura-Rind ein Kreuzungsprodukt zwischen einer *Bos taurus*- oder *Bos javanicus*-Kuh und einem *Bos indicus*-Bullen sein könnte.

Introduction

The bovin variety found on the Indonesian island of Madura, commonly known as “Madura cattle” has traditionally been considered to be essentially a *Bos javanicus* (banteng)-*Bos indicus* (Zebu) cross. The color and marking of Madura cattle (see Figure 1) might seem to suggest a banteng parentage. The red-brown or fawn coat predominant among both sexes of Maduras is found among female bantengs. A few Madura bulls have black hairs or the dark coat common to banteng bulls. Some possess the black line running along the middle of the back found in domesticated banteng. Hair on the muzzle, underside of the body, backside and stockings of Maduras is lighter, though the difference with other coat colors is not as striking as in the banteng, which has sharply defined white stockings and rump. The Madura’s head is small, though rather long. The ears are horizontal and the small horns grow from the sides with a tendency, encouraged by the Madurese, to curve upwards and inwards. Unlike the banteng, Madura bulls exhibit a hump, located slightly forward of the shoulder. The forequarters and back are well developed and muscular. The legs are moderately long, the feet small. A recent study (Direktorat Bina Produksi Peternakan, 1985) gives the following measurements for adult (48 months and over) Maduras and domesticated banteng:

Sample Size	Weight (kg)	Height at Shoulders (cm)	Length (cm)	Chest Girth (cm)
Madura bulls: 80	248.1 ± 55.9	118.9 ± 6.4	123.6 ± 6.1	150.9 ± 9.8
Madura cows: 126	203.5 ± 28.4	112.5 ± 5.1	117.0 ± 6.7	141.2 ± 8.2
Banteng bulls: 21	323.0 ± 44.6	114.0 ± 4.8	111.5 ± 15.2	161.0 ± 3.8
Banteng cows: 144	218.8 ± 30.7	111.4 ± 5.5	110.5 ± 6.4	155.1 ± 36.9

Maduras are not good milkers, indeed the cow's udders are very small. Birth weight is low (12–14 kg) and calves gain weight slowly. These shortcomings are due in part to poor nutrition. Advantages of the Madura breed include high heat tolerance, feed efficiency, thriftiness, high quality carcass and resistance to parasites.

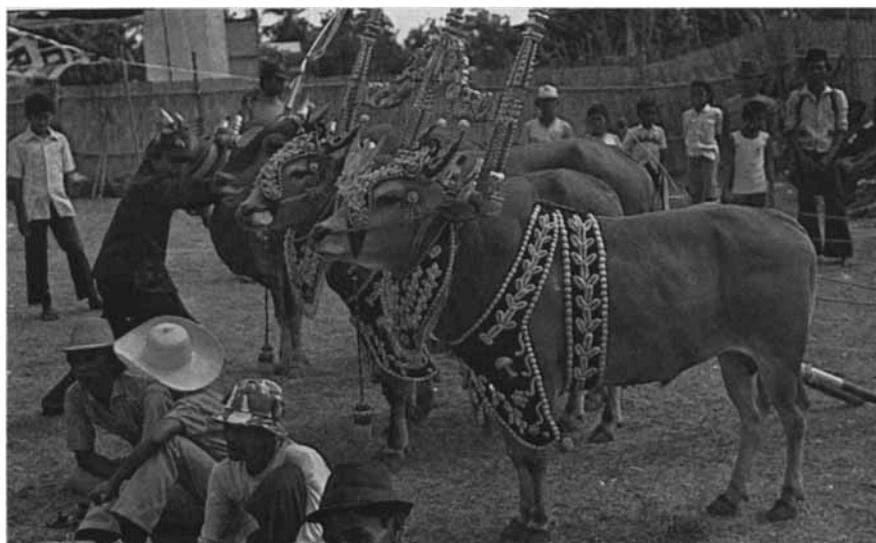


Fig. 1: Phenotypic appearance of Madura bull.

Material and Methods

For the cytogenetic study, we have used blood samples taken from six Madura bulls at the Surabaya slaughterhouse. The phenotypic appearance of this breed is shown in Figure 1. The samples were kept at low temperature during transit from Surabaya to France, and the cell cultures were immediately started following arrival. After three days in culture, the chromosomal preparations were obtained by classical methods and the chromosomes were C- and G-banded after BRDU incorporation. A cell culture for each animal, having received BRDU 8 hours before harvest, was used for R-banding.

Fig. 2: (a) G-, (b) R-, and (c) C-banded karyotypes of Madura bull.

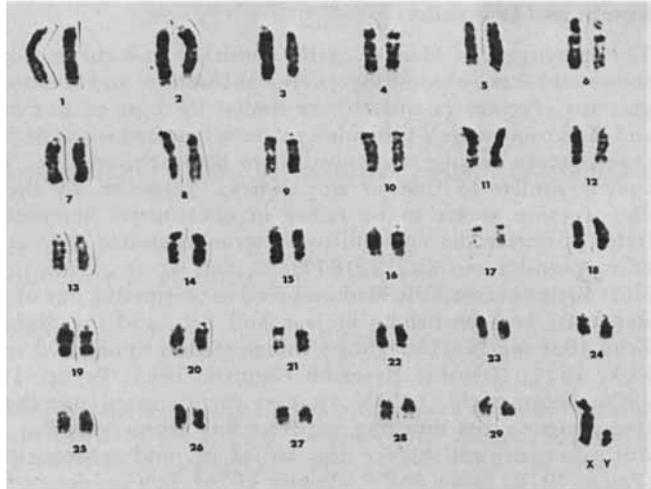


Fig. 2a

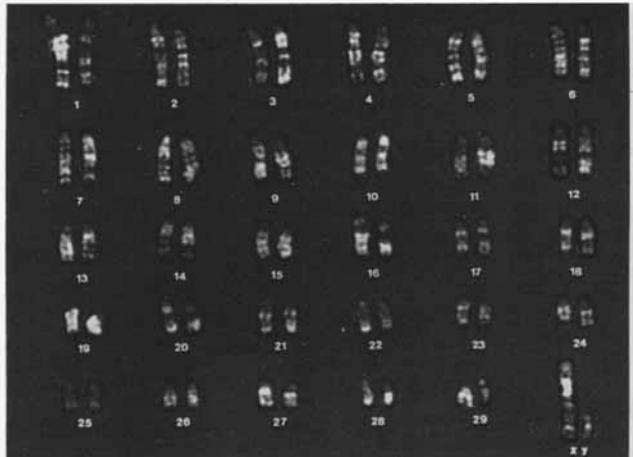


Fig. 2b

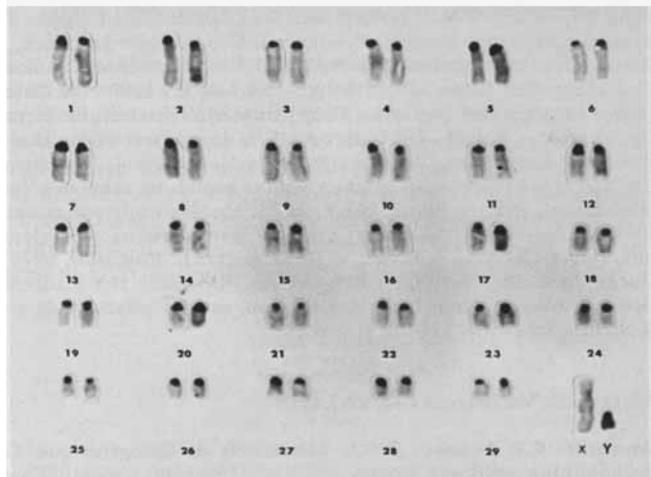


Fig. 2c

Results and Discussion

The karyotype of Madura cattle consists of 60 chromosomes, among them 58 autosomes and 2 sex chromosomes. The autosomes' and X-chromosome's G- and R-banded patterns (Figures 2a and 2b) are similar to those of *Bos taurus*. Also, the autosomes' and X-chromosome's C-banded patterns concord with the *Bos taurus* karyotype, the X chromosome lacking the constitutive heterochromatine. The Y chromosome is acrocentric similar to that of *Bos indicus*. However, by the C-Banding method the Y chromosome seems to be richer in constitutive heterochromatine (Figure 2c). The latter possesses the constitutive heterochromatine only at the distal part of the long arms (Eldridge and Blazak, 1977).

Most authors regard the Madura breed as originating out of cross breeding between *Bos javanicus*, one flourishing in Java and Bali, and the Sinhala or Ceylonese variety of Zebu (*Bos indicus*) brought by Indian traders some 1500 years ago (Atmadilaga, 1959; Kok, 1921; National Research Council, 1983; Payne, 1973; Payne and Rollinson, 1976; Sommerfeld, 1923). Another theory speculates that Javanese cattle, resulting from ancient cross breeding between *Bos taurus* and *Bos indicus*, were crossed with *Bos javanicus* well before the arrival of, and subsequent cross with, Indian Zebus (Paine, 1973; Payne and Rollinson, 1976). In a previous study, Fischer (1969) showed that the Y chromosome in *Bos javanicus* is submetacentric, similar to that of *Bos taurus*. Given the fact that the Y chromosome of Madura cattle is of *Bos indicus* type, this breed could have resulted from a cross between female *Bos taurus* or *Bos javanicus* and a male of *Bos indicus* type.

Acknowledgements

The authors thank Dr. J. Komang for his help in collecting the blood samples and E. Robertson for transporting the samples to France.

References

- Atmadilaga, D., 1959: Introduction of Red Danish dairy cattle into the Madura breed with special reference to the heat tolerance. *Communicationes Veterinariae* 3, 4--37. — Direktorat Bina Produksi Peternakan, 1985: Performance Sapi Bali di Nusa Tenggara Timur dan Sapi Madura di Pulau Madura. Direktorat Jenderal Peternakan, Departement Pertanian, Jakarta. — Eldridge, F. & W.F. Blazak, 1977: Comparison between the Y chromosomes of Chianina and Brahman crossbreed steers. *Cytogenet. Cell Genet.* 18, 57--60. — Fischer, H., 1969: Die Chromosomensätze des Bali-Rindes (*Bibos banteng*) und des Gayal (*Bibos frontalis*). *Zeitschrift für Tierzüchtung und Züchtungsbiologie* 86, 52--57. — Kok, J., 1921: Het rund en de rundveeteelt op Madoera: Een zoötechnische studie. Doctoral dissertation, Veeartsenijkundige Hoogeschool, Utrecht. — National Research Council, 1983: Little-known asian animals with a promising economic future. National Academy Press, Washington, D.C. — Payne, W.J.A. 1973: Madura study annexure: Reconnaissance report on the livestock industry. Directorate General of Water Resources Development, Ministry of Public Works and Power, Jakarta. — Payne, W.J.A. and D.H.L. Rollinson, 1976: Madura cattle. *Z. Tierzüchtg. Zuchtgsbiol.* 93, 89--100. — Sommerfeld, K., 1923: Het Madoereesche rund, de fokkerij ervan door de Madoereezen, het gebruik ervan en zijn plaats in de veeteelt van Nederlandsch-Indië. *Koloniale Studiën* 7, 170--215.

Eingang des Manuskriptes am 29.1.1988

Anschrift: C.P. Popescu, INRA, Laboratoire de Cytogénétique, Centre de Recherches de Jouy, F-78350, Jouy-en-Josas, France.