



Comparative Cytogenetic Study on Male and Female Captive Sumatran Elephant in Elephant Training Center, Way Kambas National Park

Priyambodo*, Elly Lestari Rustiati

Department of Biology, Faculty of Mathematics and Natural Sciences, University of Lampung
Jl. Sumantri Brojonegoro 1, Bandar Lampung, Lampung

Abstract



Sumatran elephant (*Elephas maximus sumatranus*) was one of five big mammals in Way Kambas National Park (WKNP). Cytogenetic study was a part of conservation effort for sumatran elephant, especially in conservation genetic field. Captive sumatran elephant's blood in Elephant Training Center (ETC) WKNP was collected to karyotype analysis. Captive sumatran elephant's chromosome was analyzed by squashing technique with pretreating cells in a hypotonic solution. The study of karyotypes were made by giemsa staining applied to captive elephant's blood cell. The diploid number of captive sumatran elephant was 56 both in male and female. The karyotype analysis performed different fundamental number (FN) in male and female, but same fundamental autosomal number (FNa). Chromosome of female sumatran elephant showed the FN = 8, and FNa = 6, but in male sumatran elephant FN = 7, and FNa = . The karyotypes of X chromosome was large submetacentric and Y chromosome was small acrocentric. The karyotype presented here will be compiled with DNA fingerprinting analysis of all captive sumatran elephant in ETC WKNP as references in future breeding policy.

Keywords: captive sumatran elephant, karyotype analysis

Introduction



- ❑ Sumatran elephant (*Elephas maximus sumatranus*) was one of five big mammals in Way Kambas National Park (WKNP), besides sumatran rhino, sumatran tiger, tapir, and bear.
- ❑ IUCN classified the sumatran elephant as critically endangered species since 2011 (Gopala et al., 2011).
- ❑ In WKNP, sumatran elephant was categorized as wild elephant and captive elephant. The captive sumatran elephant can be found in Elephant Training Center (ETC).

Introduction



- ❑ Rustiati & Priyambodo (2016) were collected the DNA samples of sumatran elephant for preliminary study of phylogenetic analysis in order to decreased the negative effect of gene flow in small population of ETC WKNP.
- ❑ The cytogenetic study of captive sumatran elephant in ETC WKNP has not been done.
- ❑ Previous cytogenetic studies have been reported for asiatic elephant (Hungerford et al., 1966; Norberg, 1969).

Methods

MALE



AGAM

**Born in 1979
In ETC WKNP since 1991
From Padangcermin
Mahout: Kholidin**

FEMALE



BUNGA

**Born in 1983
In ETC WKNP since 1998
From Purbolinggo
Mahout: Dwi Hari**

Methods



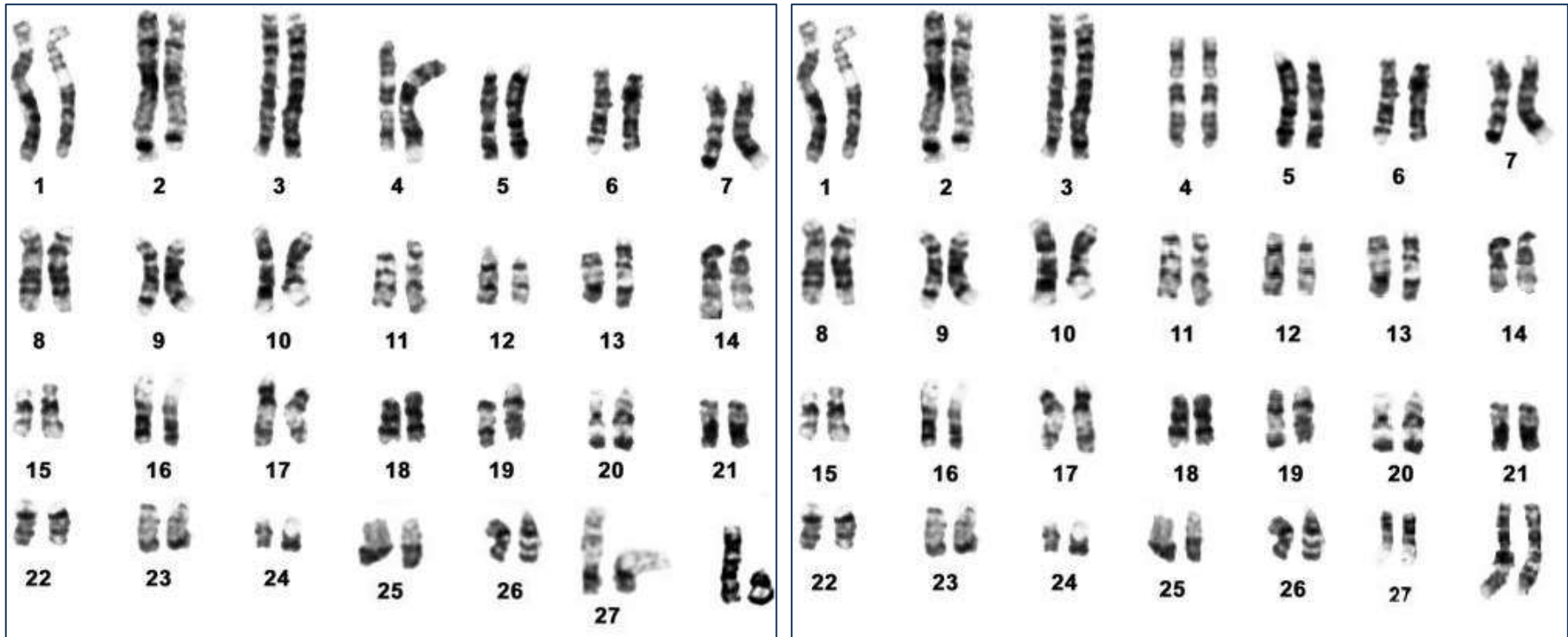
- ❑ All the samples were acquired from captive population in Elephant Training Center, Way Kambas National Park, Lampung, Indonesia.
- ❑ Chromosomes from two sumatran elephants were harvested from cultured blood in Dulbecco's Modified Eagle's Medium with fixated by formaldehid (in previous stage).

Methods



- Pro-metaphase chromosomes of all samples were examined by Giemsa staining method.
- Autosomes were arranged in order of size with acrocentric/telocentric autosomal pairs preceding metacentric/submetacentric pair.

Results and discussion



Cytogenetic analysis for Agam (left) and Bunga (right)

Results and discussion



- ❑ The normal diploid number of the sumatran elephant was 56.
- ❑ The normal ($2n = 56$) karyotype consisted of 24 acrocentric/telocentric autosomal pairs and three metacentric/submetacentric autosomal pairs (12, 24, 27).
- ❑ Chromosome complements were $2n = 56$ although it was distinguished by having one less small acrocentric pair and one additional small submetacentric pair.
- ❑ Chromosome complements were $2n = 56$ in *E. maximus* was distinguished by having one less small acrocentric pair and one additional small submetacentric pair.

Results and discussion



Fundamental number (FN) is the number of visible mayor chromosomal arm per set chromosomes



Fundamental autosomal number (FN_a) is the number of visible mayor autosomal arm per set chromosomes



AGAM

FN = 7

FN_a = 6



BUNGA

FN = 8

FN_a = 6

Further analysis

- Complete cytogenetic profil:
 - Centromeric index
 - Idiogram analysis



Conclusion

Both of male and female sumatran elephant have 27 autosomes, included 23 acrocentric/telocentric, and three submetacentric/metacentric. Both of male and female sumatran elephant has large submetacentric X, and small acrocentric Y found in male sumatran elephant.



Acknowledgements



We thank to Directorate of Research and Community Services, Higher Education Indonesia for research grant, Way Kambas National Park for the scientific collaboration and Veterinary Bureau Lampung Province for Biomolecular analysis works. The authors appreciate greatly the help of Berry Fachry Hanifa, M.Sc. for all supports.

References



Gopala, A., Hadian, O., Sunarto, ., Sitompul, A., Williams, A., Leimgruber, P., Chambliss, S.E. & Gunaryadi, D. 2011. *Elephas maximus* ssp. *sumatrensis*. The IUCN Red List of Threatened Species 2011.

Hartl GB, Kurt F, Wolfgang H, Nadlinger K: Electrophoretic and chromosomal variation in captive Asian elephants (*Elephas maximus*). *Zoo Biol* 14:87–95 (1995).



Hungerford DA, Sharat Chandra H, Snyder RL, Ulmer Jr FA: Chromosomes of three elephants, two Asian (*Elephas maximus*) and one African (*Loxodonta africana*). *Cytogenetics* 5:243–246 (1966).

Hsu TC, Benirschke K: *Elephas maximus* (Indian or Asian elephant) $2n = 56$, in Hsu TC, Benirschke K (eds): An Atlas of Mammalian Chromosomes, Vol 5, Folio 239 (Springer-Verlag, New York 1971a).



Kim, D.S.; Nam, Y.K.; Noh, J.K.; Park, C.H.; Chapman, F.A. (2005). Karyotype of North American shortnose sturgeon *Acipenser brevirostrum* with the highest chromosome number in *Acipenseriformes*. *Ichthyological Research*. 52 (1): 94–97.

Norberg HS: The chromosomes of the Indian female elephant (*Elephas indicus* syn. *E. maximus* L.). *Hereditas* 63:279–281 (1969).



Rustiati, E. R. & Priyambodo. 2016. Genomic DNA Isolation of Gajah Sumatera (*Elephas maximus sumatrensis*) In Elephant Training Center, Way Kambas National Park, East Lampung. Proceeding of 3rd International Wildlife Symposium: 91-93.

Thank you...

