

Population markers of the German origin red deer (*Cervus elaphus hippelaphus*) in Southern Russia: cytochrome *b* and the acoustics of rutting calls



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AIM The "Voronezh" red deer population originated in XIX century from about 10 individuals introduced from Germany to the Southern Russia. This population serves for re-storing red deer on the European plain part of Russia, where the native red deer are extinct.

We describe the acoustic and genetic peculiarity of "Voronezh" red deer related to European red deer, Pannonian *C.e. hippelaphus* (mtDNA C haplogroup) and Iberian *C.e. hispanicus* (mtDNA A haplogroup).

METHODS

Acoustics:



SongMeter SM2+

September-October 2016,
 ~200 free-ranging stags

We analysed 467 bouts including in total 1335 stag rutting roars

Genetics:

Voronezh red deer: 3 locations – 44 samples
 Iberian red deer, Spain: – 23 samples
 Pannonian red deer, Hungary: – 7 samples
 mtDNA cytochrome *b* gene (1031 bp)

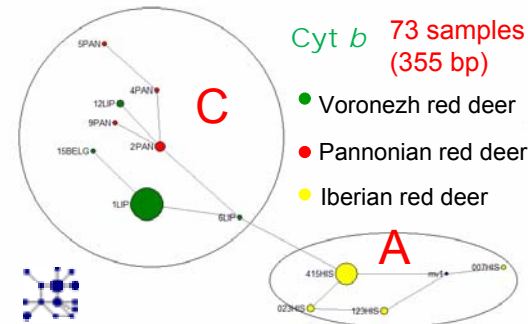


MEGA 6

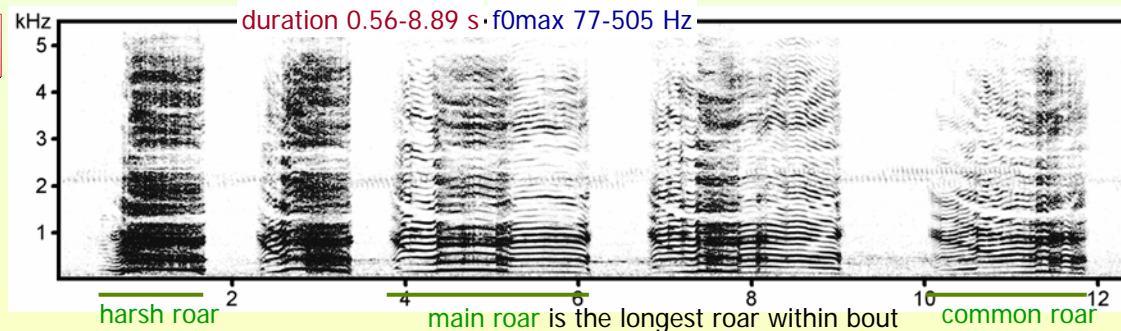


Network 4.5

Median-joining network

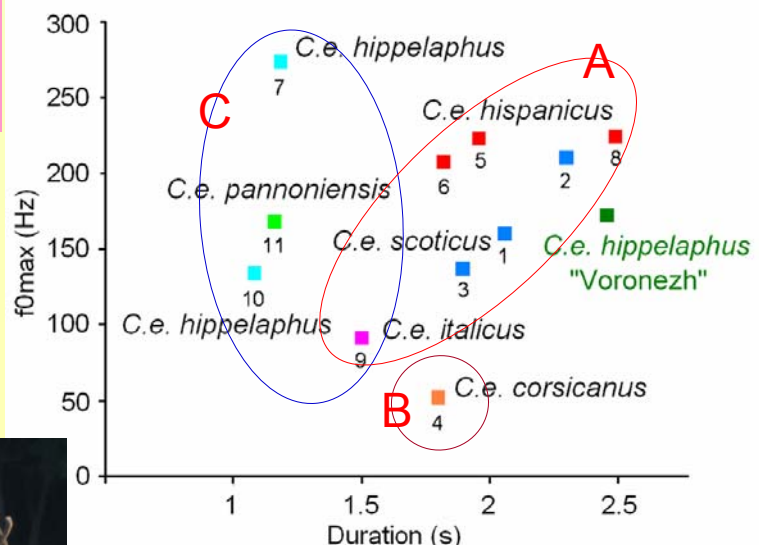


Acoustic results



Genetic traits indicate that Voronezh red deer are strongly different from Iberian red deer and close to Pannonian red deer.

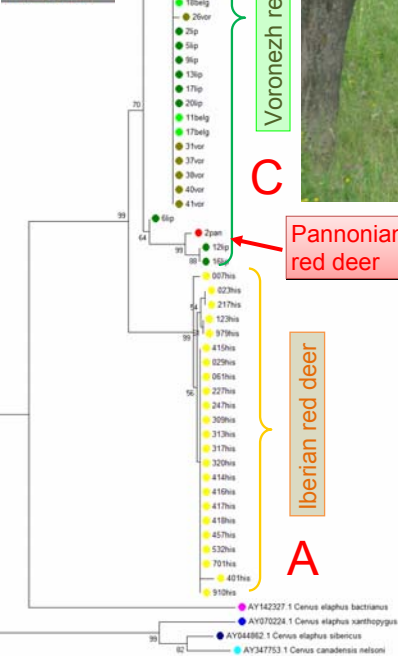
Main roar acoustics across European red deer



Genetic results

54 samples (1031 bp)

Cyt *b*



Rutting roars acoustics

Parameter	Voronezh deer	Pannonian deer [11]	Iberian deer [5]
Roars per bout	2.85±1.89	3.18±2.17	2.11±1.71
Main roar			
Duration (s)	2.46±1.14	1.13±0.50	1.90±0.50
f0max (Hz)	175±60	168±61	224±34
Main common roar	66 %	83 %	89 %
Main harsh roar	34 %	17 %	11 %
Main roar = high frequency roar	56 %	57 %	94 %

Acoustic traits separate Voronezh red deer from both Iberian and Pannonian red deer.



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1. McComb 1988; 2. Long et al. 1998; 3. Reby and McComb 2003; 4. Kidjo et al. 2008; 5. Frey et al. 2012; 6. Passilongo et al. 2013; 7. Bocci et al. 2013; 8. Volodin et al. 2015; 9. Della Libera et al. 2015; 10. Hurtado et al. 2012; 11. Volodin et al. 2019