



## SEX RATIO OF RUMEX ACETOSA SEEDS OBTAINED FROM POLLINATION WITHIN AND BETWEEN POPULATIONS

JAKUB BIZAN \*, MAGDALENA DENYSENKO, DAGMARA KWOLEK, ANDRZEJ J. JOACHIMIAK

**Key words:** *Rumex acetosa*, sex ratio, seeds, genetic marker

Department of Plant Cytology and Embryology, Jagiellonian University, Gronostajowa 9, 30-387 Cracow, Poland;  
\* jakub.bizan@uj.edu.pl

*Rumex acetosa* L. (common sorrel) is a dioecious, wind pollinated plant with an XX/X<sub>Y</sub><sub>1</sub>Y<sub>2</sub> sex chromosome system. Sex-ratio in the populations of dioecious plants is rarely even; generally it is skewed towards one gender. *Rumex* populations showed female sex-ratio bias at all of the stages of development, but the difference in sex proportion was smaller in earlier stages (STEHLIK *et al.* 2008). Moreover, sex-ratio bias varied in different populations of the same species (ZARZYCKI & RYCHLEWSKI 1972). The possible causes of unequal proportion of males and females are: certation, sex-dependent germinability of seeds, and/or difference in mortality of gametophytes, embryos, and plants (BŁOCKA-WANDAS *et al.* 2007).

The plants originating from two distant populations in S Poland (Dobranowice and Wieliczka) were isolated and pollinated in a controlled condition to minimize the influence of certation. The pollinations were following: DW – ♀ from Dobranowice and ♂ from Wieliczka, WD – ♀ from Wieliczka and ♂ from

Dobranowice, and DD – ♀ from Dobranowice and ♂ from Dobranowice. Seeds obtained from each experiment were collected and examined for sex by PCR.

Two pairs of PCR primers that amplify sequences located in Y chromosomes were used: RAY-f and RAY-r (KORPELAINEN 2002), and UGR08-r and UGR08-f (MARIOTTI *et al.* 2009). To confirm the good quality of isolated DNA an amplification of autosomal sequence using R730-a and R730-b primers were carried out (NAVAJAS-PERÉZ *et al.* 2005). The same set of primers was successful in our previous studies on sorrel (KWOLEK & JOACHIMIAK 2010).

Sex ratios of WD and DW seeds were similar, but clearly differed from the observed in DD seeds (Tab. 1). Progeny produced by parents from different populations showed much larger proportion of females than progeny of parents originated from the same population. The finding requires further investigations to verify the results and to explain the mechanisms underlying the observed phenomenon.

**Table 1.** Seed sex ratios of *Rumex acetosa*: **N** – number of analyzed seeds; **F** – number of female seeds; **M** – number of male seeds; **FF** – frequency of females expressed as proportion of females to total (according to KORPELAINEN 2002); **MF** – sex ratio expressed as 1:F/M (according to RYCHLEWSKI & ZARZYCKI 1975).

♀♂	N	F	M	FF	MF
DW	76	55	21	0,72	1:2,62
WD	96	70	26	0,73	1:2,70
DD	96	57	39	0,59	1:1,46

## References

- BŁOCKA-WANDAS M., SŁIWIŃSKA E., GRABOWSKA-JOACHIMIAK A., MUSIAŁ K., JOACHIMIAK A.J. 2007.** Male gametophyte development and two different DNA classes of pollen grains in *Rumex acetosa* L., a plant with an XX/XY<sub>1</sub>Y<sub>2</sub> sex chromosome system and female-biased sex ratio. *Sex. Plant Repr.* **20**: 171–180.
- KORPELAINEN H. 2002.** A genetic method to resolve gender complements investigations on sex ratios in *Rumex acetosa*. *Mol. Ecol.* **11**: 2151–2156.
- KWOLEK D., JOACHIMIAK A. 2010.** Seed sexing revealed female bias in two *Rumex* species. *Acta Soc. Bot. Pol.* **80**: 93–97.
- MARIOTTI B., MANZANO S., KEJNOVSKY E., VYSKOT B., JAMILENA M. 2009.** Accumulation of Y-specific satellite DNAs during the evolution of *Rumex acetosa* sex chromosomes. *Mol. Gen. Genom.* **281**: 249–259.
- NAVAJAS-PERÉZ R., DE LA HERMAN R., JAMILENA M., LOZANO R., RUIZRUIZ REJÓN M., GARRIDO-RAMOS M.A. 2005.** Reduced rates of sequence evolution of Y-linked satellite DNA in *Rumex* (Polygonaceae). *J. Mol. Evol.* **60**: 391–399.
- RYCHLEWSKI J., ZARZYCKI K. 1975.** Sex ratio in seeds of *Rumex acetosa* L. as a result of sparse or abundant pollination. *Acta Biol. Cracov. Ser. Bot.* **18**: 101–113.
- STEHLIK I., FRIEDMAN J., BARRETT S.C.H. 2008.** Environmental influence on primary sex ratio in dioecious plant. *Proc. Nat. Acad. Sci. USA* **105**: 10847–10852.
- ZARZYCKI K., RYCHLEWSKI J. 1972.** Sex ratios in Polish natural populations and in seedling samples of *Rumex acetosa* L. and *R. thyrsiflorus* Fing. *Acta Biol. Cracov. Ser. Bot.* **15**: 135–151.