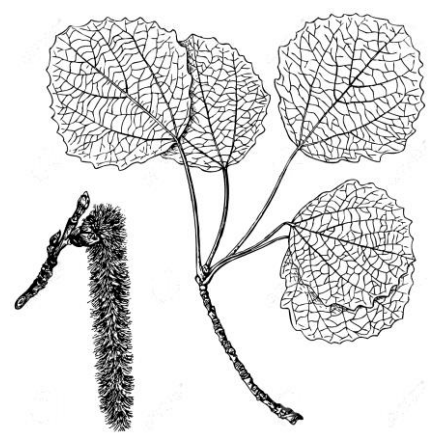


The Presence of stem rot in hybrid aspen (*Populus tremula* L. × *Populus tremuloides* Michx.) plantations taking into account the effects of clones, environmental factors and tree parameters

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Aspen hybrid clones can be grown for a variety of growing purposes - sawlogs, pulpwood and energy wood. Hybrid aspens grow on plantations where there are no underlay trees, ground floor trees, etc., thus increasing the impact of climate disturbance on their growth, including an elevated risk of frost-related damage. Frost cracks not only damage the quality of the wood, but they can potentially create a place through which the fungal infections can enter, which can decrease tree vitality and lead to the destruction of trees. Within breeding programs, selecting clones that are immune to fungal infection is a major subject. Knowing the morphological and physiological factors that affect tree productivity and the pathogens that limit population distribution can lead to faster and more effective results. The aim of the study was to assess aspen frost crack significance which potentially could cause the development of stem rot fungus.

Material and methods

The research was conducted in three adjacent hybrid aspen trials in Latvia's central region. Stem cracks appeared in the winter of 2012/2013, impacting the majority of trees – 457 (67%) in trial No 699, 325 (72%) in 640, and 103 (65%) in 620. The length of the cracks was measured in April of 2013.

The severity of bark cracks was graded on a four-point scale: (0) no injuries; (1) bark crack but no visible wood; (2) bark crack with visible wood; and (3) bark crack wider than 1 cm.

Height and diameter at breast height were measured for all trees. Immediately after the inventory, systematic thinning was carried out in trials, removing on average 61% of the trees. For harvested trees, stump diameter was measured, the number of large poplar borer (*Saperda carcharias*) passages on stump surface counted.

Stem rot stage assessed in four grade scale: (0) tree without signs of rot; (1) wood discoloration; (2) In the middle, a decolorized rotting wood is surrounded by a discolored diseased wood.; (3) a darkly pigmented response zone separating diseased sapwood from sound sapwood. Mixed model analysis was used to estimate the significances between tree growth and environmental factors.

Results

Rot was present for majority of trees in all three plantations (620, 640, 699; 75%, 77%, 87%, respectively). Clone was a significant factor affecting presence of rot in two least affected trials (640 and 699). In the most rot-infected trail clone and stem crack interaction was a significant factor affecting presence of rot, in other trails – interaction between clone, replication and stem cracks (Table1). The diameter and height did not have a significant effect on the development of the rot (Table 1) and the first stage of the rot which indicating recent infection, was present in different tree dimensions. The clone had a significant effect on the development of the rot in experiments 640 and 699 (Table 1), and the clones least affected by the rot were 41, 43, 36 and 25, 41, 44 out of 30, respectively (Figure 1). The trial 699 also showed that cracks had a significant effect on the development of the rot, for example, where were clones with a large number of individuals without cracks (41; 43 and 44). The large poplar borer *Saperda Carcharias* showed a significant role in the development of the rot, and interaction between growth traits and cracks has a significant effect in its infestation (trial 699).

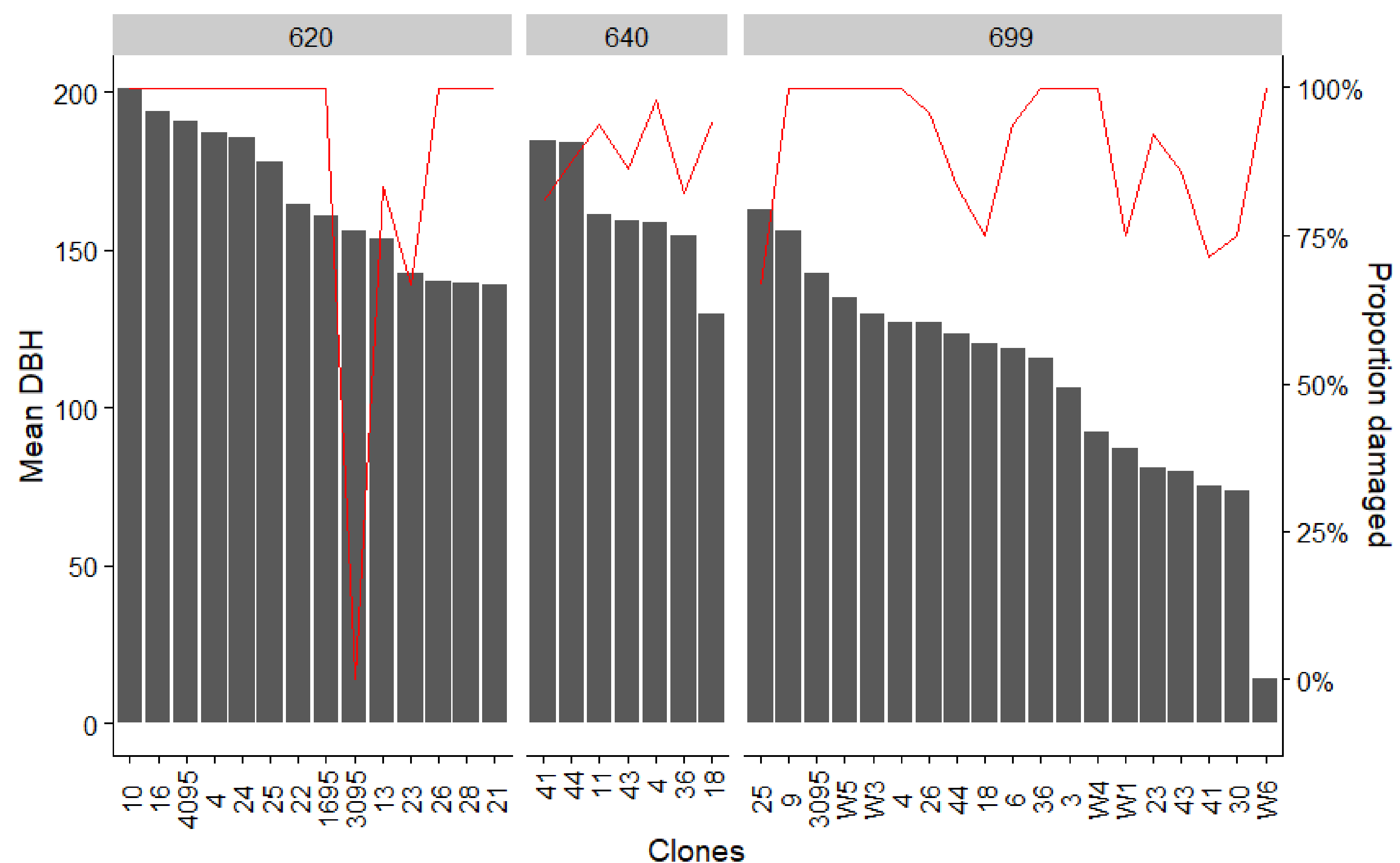


Figure 1. Distribution of all studied clones by diameter and tree damage (included rot and frost crack (third (3) grade scale: bark crack wider than 1 cm). Mean diameter at breast height (DBH) has shown with the bars and tree damages by the red line.

Table 1. Factors affecting presence of the rot. * significant, NS –non-significant ;“- “ not included in the model; “rep”: replication. Column “Rot”: the model with stem rot, column “Insects”: aspen rot model, where is additionally added the presence of insects.

Factors	620		640		699	
	Rot	Insects	Rot	Insects	Rot	Insects
Crack	NS	NS	NS	NS	*	NS
Clone	NS	NS	*	*	*	*
H	*	NS	-	-	-	-
D	-	-	-	NS	NS	NS
Rep	NS	NS	*	*	NS	NS
Crack: clone	*	NS	NS	NS	NS	NS
Crack: clone: rep	-	NS	NS	*	*	*
Crack: H: rep	-	NS	-	-	-	*
Crack: D: rep	-	-	-	*	*	-
Clone: H: rep	-	NS	-	-	-	-
Clone: D: rep	-	-	-	*	*	*
Crack: clone: D	-	-	-	*	NS	*
Crack: rep	-	NS	NS	*	NS	NS

Conclusion

The development of the rot in the aspens is significantly impacted by the specific clone and environmental factors, so the most potentially resistant clones should be selected during the next hybrid aspen plantations and environmental disturbances should be eliminated as far as possible.