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PCR-SSCP analysis of GH gene in Sarda goats: a high variability and its preliminary effects on dairy performances

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Preliminary research on environmental impact of woodland grazing by pigs

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ABSTRACT - 6 castrate pigs about 30 kg live weight each entered in a fence into hilly woodland area. The pigs were bred until about 140 kg live weight. After 10 months of pasture breeding, the environmental damages (cover ground, plants and soil characteristics) by rooting and trampling were evaluated. The damages to cover ground and to shrubs and to physical structure (Fissures and Aggregate stability) caused hydro-geological instability with soil erosion and landslides. Removing surface layers of soil caused considerable loss of organic matter (Total Organic Carbon and Total Nitrogen), microbial activity (Microbial ATP and breathing) and enzyme activity changes (Total β–glucosidase and Extra cellular β–glucosidase). Damages to native plants are different in relation to the root and the trunk kinds, and to the palatability of leaves and apexes which result inversely related whit the abundance of disagreeable substances content (ADL, Tannins, Resins, Latex).

Key words: Pig, Grazing woodland, Plants damages, Soil damages.

Introduction – The breeding of grazing pig system is normally used in Spain and North Europe. In recent years in Italy this rearing system has expanded rapidly for two reasons: the increase of organic farm and the natural abundance of marginal areas used especially with local breeds at risk.

Pigs in organic production should be able to express their natural behaviour for rooting and grazing, larger areas and outdoor runs occupy pigs giving them more possibilities to be active (Hook Presto *et al.*, 2008) but it determines environmental damages especially in forest. The environmental damage caused by pigs is almost unknown, the studies carried out by foreign authors in Northern European countries (England, Sweden, Germany and Denmark) concern negative environmental effects such as soil erosion and nitrogen losses to groundwater and to atmosphere (Williams *et al.*, 2000; Evans, 2004), soil compaction (Brandt *et al.*, 1995), N loss to atmosphere via denitrification (Petersen *et al.*, 2001) and volatilisation (Sommer *et al.,* 2001), increase risks of nitrogen leaching (Eriksen, 2001). Therefore we can not transfer the results to our Mediterranean area, in fact few studies concern the environmental effects of pig grazing. In this research the different aspects of environmental impact by grazing pigs in woodlands with high slope have been dealt.

Material and methods - The research took place in an Appennino Ligure organic agroforestry farm in which a 5000 m^2 slope area was chosen. The area was characterised by terracing with stone walls and by the presence of shrubs and trees:. Pine (*Pinus pinaster)*, Holm (*Quercus ilex)*, Chestnut *(Castanea sativa),* Bramble *(Rubus fruticosus)*, Euphorbia *(Euphorbia characias)*, Arbutus *(Arbutus unedo)*, Oak *(Quercus peduncolata)*, Hether *(Erica arborea)*, Wild Apple Tree (*Malus sylvestris)*, Elder *(Sambucus nigra)*. The experimental area was fenced with a sturdy wire mesh, which was put into the ground for 30 cm. Inside the fence, a wood stable was built with mangers and watering places. The trial started when 6 castrate pigs (Large White x Duroc; about 30 kg live weight each) entered in this area and it finished 10 months later when they reached about 140 kg live weight and they were

Table 1. The extent of plant damage.

Plants	Roots	Trunk	Leaves and apexes
Olive	***	--	**
Pine	--	--	--
Holm	*	*	*
Chestnut	--	*	*
Bramble	--	--	***
Euphorbia	*	--	--
Arbutus	***	***	--
Oak	*	--	*
Heather	--	*	*
Wild Apple Tree	***	**	**
Elder	***	***	***

*-- 0 damage, *low damage (1-30% of plants), **medium damage (30-70%), ***high damage (70-100%).*

fed with a ration calculated on weight. During the trial every tree and shrub were catalogued, photographed and the damage due to the animals on the branches and on the tillers (browsing), on the roots (rooting) and on the trunks (debarking by scratch) were observed. On the eaten and refused forest species it was been determined the content of reducing palatability substances as ADL, Tannins and ether soluble substances (EE). The percentages of disturbed areas by rooting, trampling and landslide were evaluated and these areas were divided in: peripheral zone (along the network of fences), grassy area and wooded area. Furthermore the percentage of stone walls landslide because of pigs was quantified. At the end of the trial random soil samples in the disturbed area (inside the fence) were collected to verify the changements of the physical- structural (Fissures, Aggregate stability) chemical (pH, Electric Conductibility, Total Organic Carbon, Total Nitrogen) and biochemical parameters (Microbial ATP and breathing, Total β–glucosidase, Extra cellular β–glucosidase), respect to the samples collected in the undisturbed area (out of the fence), these parameters were determined by SISS Method.

Results and conclusion – Entire forest area was damaged by grazing pigs. There were different both in intensity damages and in ways in relation to position, cover ground and the kind of plant. The peripheral zone was the most disturbed by trampling and a part of it was collapsed. The damages inside the fence were especially caused by rooting in woodland zone, and by trampling in grassy area, that was partially collapsed. Probably the landslides were caused by action of rain because the grass was destroyed by the animals. The stone walls were completely destroyed. The extent of plant damages was related to a lot of factors (Table 1). The root damages caused by rooting pigs depend on root characteristics: the trees with depth, large and thick roots (as Chestnut, Holm and Oak), are very resistant to the griffin of pigs while the trees with thin, tender and superficial roots (as Olive, Elder, Arbutus and Wild Apple Tree), were easily undermined, the roots were bared and the plants suffered a great damage. The trunk damages were caused by the pig habitus to scratch themselves which caused the barking of the trees and sometimes their death. The extent of the debarking damage depends on the mechanical resistance of bark to the friction action produced by the pig body against the trunk. Olive, Chestnut, Oak, Pine, Holm have an hard and strong bark therefore they are much more resistant to the debarking than Elder, Arbutus and Wild Apple Tree,

Table 2. Disagreeable substances content in leaves apexes (%DM).

Plants	EE *	ADL	Tannin
Olive	2.51	28.62	3.36
Pine	2.78	19.33	6.30
Holm	3.02	26.30	6.38
Chestnut	5.43	17.58	7.55
Bramble	1.70	12.90	1.59
Euphorbia	7.73	12.09	2.32
Arbutus	2.08	32.34	4.50
Oak	2.82	21.36	7.73
Heather	4.39	35.74	5.65
Wild Apple Tree	2.95	15.91	3.93
Elder	4.06	8.47	1.83

**EE: fat, resin, wax, latex, sterols.*

which have thin and tender bark that are seriously injured. Trees and tillers with thin trunks are often fallen. The damages produced by browsing to the trees and shrubs depend on two factors: the high above ground of the branches and the presence of tillers, that offer the possibility of browsing leaves and apexes by the animals. The high trunk plants suffer injuries only when are young; the attractiveness depends by tree kind of substances disagreeable to animals: lignin (ADL), resin, wax, latex (EE) and tannin (Table 2). Chestnut, Holm and Oak have tannins major 6% in leaves and apexes therefore these trees are low browsed. Heather and Arbutus leaves have tannins about 5% and high lignin content and so they are completely refused, Euphorbia with low lignin and tannins, but high resin is refused too. Olive and Wild Apple Tree leaves and apexes are agreeable especially in young portions. Elder and Bramble have low lignin, resin and tannin percentages and so they are the most agreeable to the pigs, which browse the Bramble although the thorns. The pig grazing physic-structural characteristics of the soil (Fissures, Aggregate stability) caused worsening (Table 3). Porosity loss and lack of water infiltration determined erosion which remove surface layers of soil cause considerable loss of organic matter (C organic and N Total decrease). All that causes microbiological characteristics worsening evaluated by number and activity microorganisms reduction (Microbial ATP and breathing decrease). The deterioration of the biochemical characteristics are evaluated by enzyme parameters (β–glucosidase and Extra cellular β–glucosidase linked to humus) which was remarked by N organic fix capacity and going to induce irreversible process of desertification (Ceccanti and Masciandaro, 2003).

These preliminary results show that the number of head/ha (lower than n° 1804/99 Organic Regulation) caused an high environmental impact on woodland, especially when it is on slope area.

Table 3. Physical-structural, chemical and biochemical characteristics of soil

	Undisturbed Area	Rooting Disturbed	Trampling Disturbed
Fissures (%)	8.70 ± 0.39	6.71±0.50	6.12±0.26
Aggregate stability (%)	73.30 ± 2.50	44.40±2.80	40.40±3.40
pH	8.00 ± 0.20	8.10±0.00	8.10±0.30
Electric Conductibility (mS/cm)	0.34 ± 0.04	0.38±0.06	0.37±0.01
Total Organic Carbon (%DM)	3.47 ± 0.26	2.37±1.24	1.82±0.78
Totan Nitrogen (%DM)	0.33 ± 0.01	0.17±0.10	0.13±0.04
Microbial ATP (mgATP/gDM)	1515.90 ± 151.86	1156.70±187.39	1133.33±110.86
Microbial breathing (mgC-CO2/ $kg^{-1}d^{-1}$)	27.80 ± 0.50	22.50±3.50	20.10±1.80
Total β-glucosidase (mgPNF/gDM*h)	119.53 ± 15.37	108.29±5.83	92.60±84.18
Extracellular b-glucosidase (≤ ≤)	23.97 ± 4.24	10.04±0.56	3.45±0.89

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