

Seasonal dynamics of *in vitro* fermentation of two woody plants *Phillyrea media* and *Rubus fruticosus*: Kinetic and methanogenic profiles

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INTRODUCTION & AIM

In the Mediterranean humid zones of Algeria, fodder shrubs constitute a key nutritional resource for small ruminants managed under extensive grazing systems. Their evergreen foliage, available throughout the year, helps to bridge seasonal feed gaps caused by drought and limited herbaceous growth. Owing to their strong ecological adaptation, resilience, and regenerative capacity after browsing, these woody species are essential for the sustainable management of natural rangelands and for maintaining livestock feed security.

However, despite their agro-ecological and nutritional importance, knowledge on their chemical composition, nutritive value, and digestibility remains limited. Since digestibility is a critical determinant of forage quality and animal performance, its evaluation through *in vitro* gas production techniques offers a reliable means to estimate microbial degradation of plant material within the rumen and to assess their potential as alternative feed resources. This study investigates the seasonal variation in the *in vitro* fermentation of *Phillyrea media* and *Rubus fruticosus* leaves from northeastern Algeria, and examines the role of polyethylene glycol (PEG) in mitigating the antinutritional effects of condensed tannins.

The *in vitro* gas production kinetics highlight a markedly higher digestibility of *Phillyrea media* compared to *Rubus fruticosus*, with this difference becoming particularly pronounced after 72 hours of incubation. In *P. media*, a clear seasonal effect is observed, characterized by significantly greater gas production in autumn than in spring. Conversely, *R. fruticosus* exhibits a relatively stable fermentation pattern across seasons. The observed differences in fermentation profiles are closely related to the specific chemical composition of each species, mainly reflecting variations in cell wall constituents and secondary metabolites.[2]

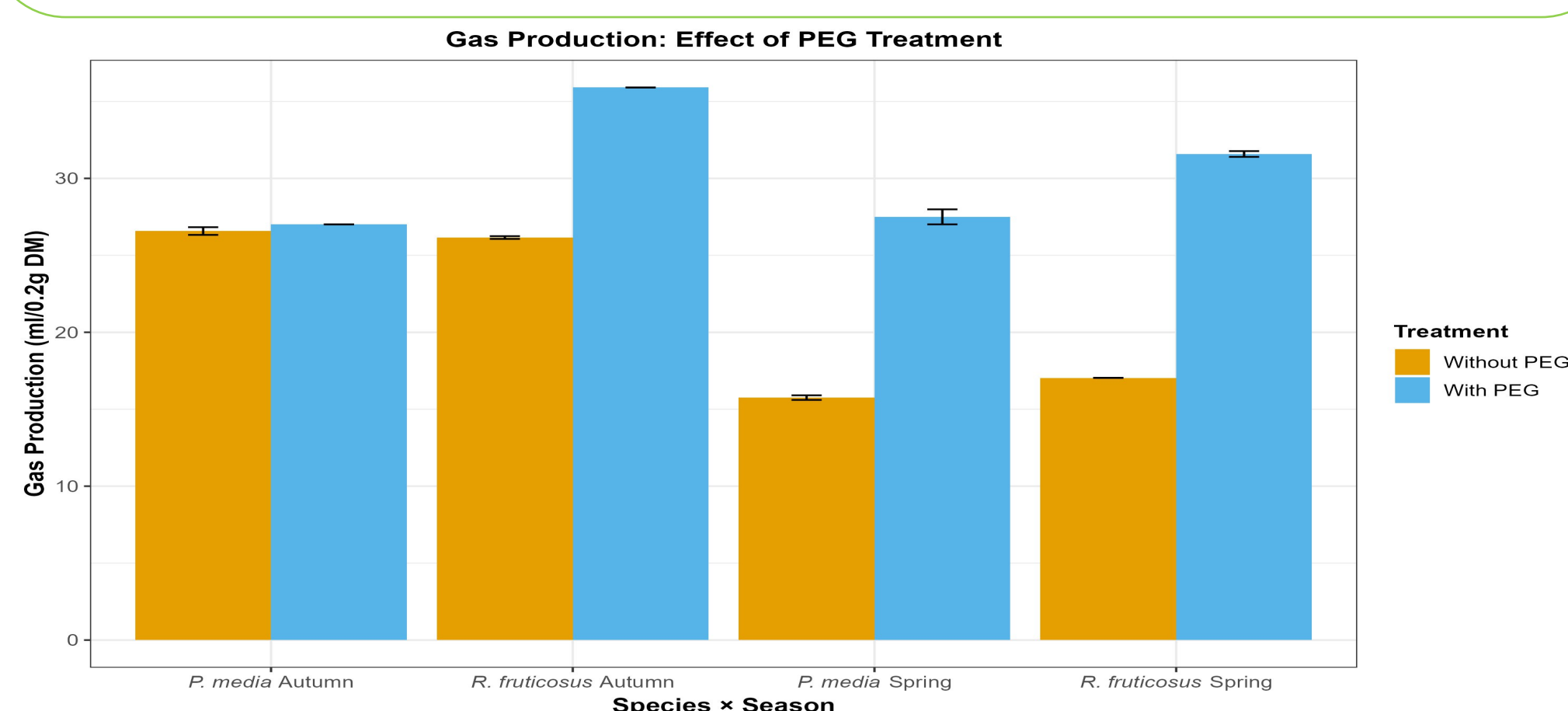


Figure3: *in vitro* gas production of *R. fruticosus* and *P. media* according to season (with and without PEG).

METHOD

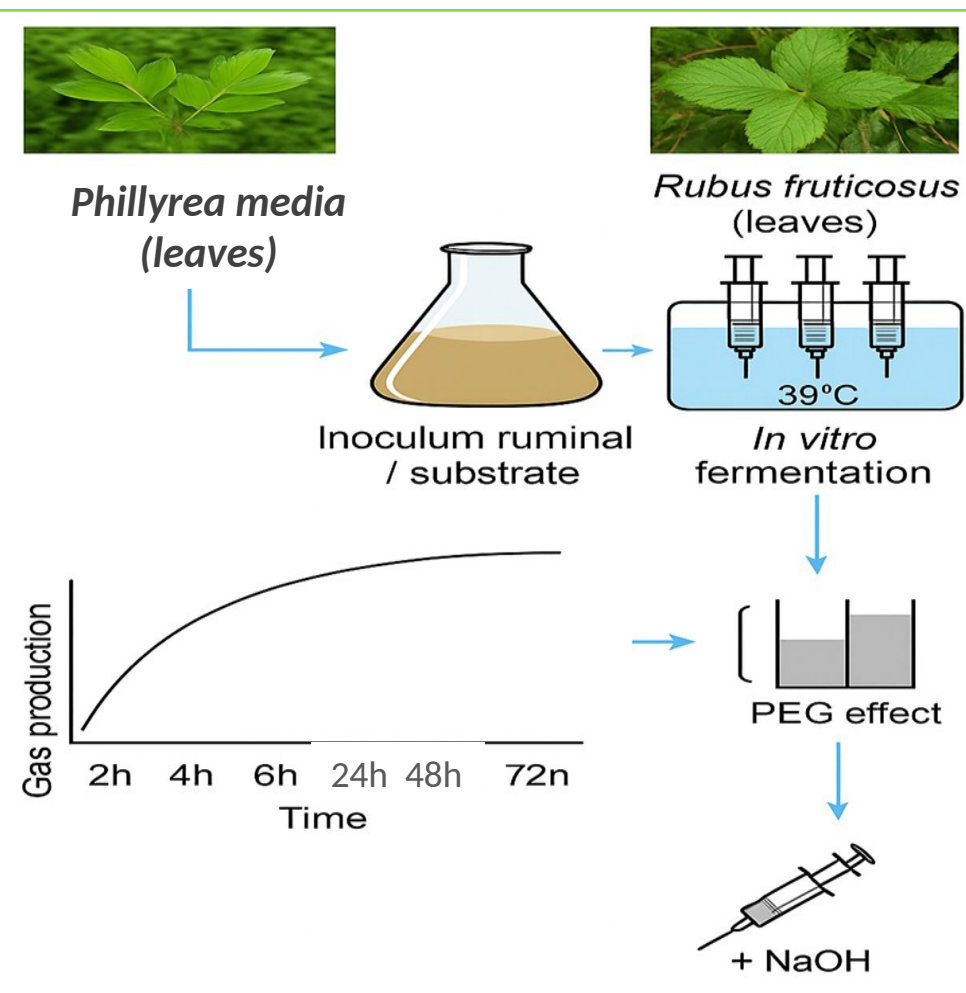


Figure1: experimental scheme of the *in vitro* fermentation of two woody species

Dried leaves of two forage shrub species, *Phillyrea media* and *Rubus fruticosus*, were incubated *in vitro* using the glass syringe technique described by Menke and Steingass in 1988 [1]. Gas production kinetics were monitored at 2, 4, 6, 24, 48, and 72 hours of incubation. The effect of polyethylene glycol (PEG, 0.2 g per syringe) was assessed through parallel incubations conducted with and without PEG addition. After each 24-hour incubation period, 4 mL of 10 N NaOH were injected into each syringe to quantify methane production.

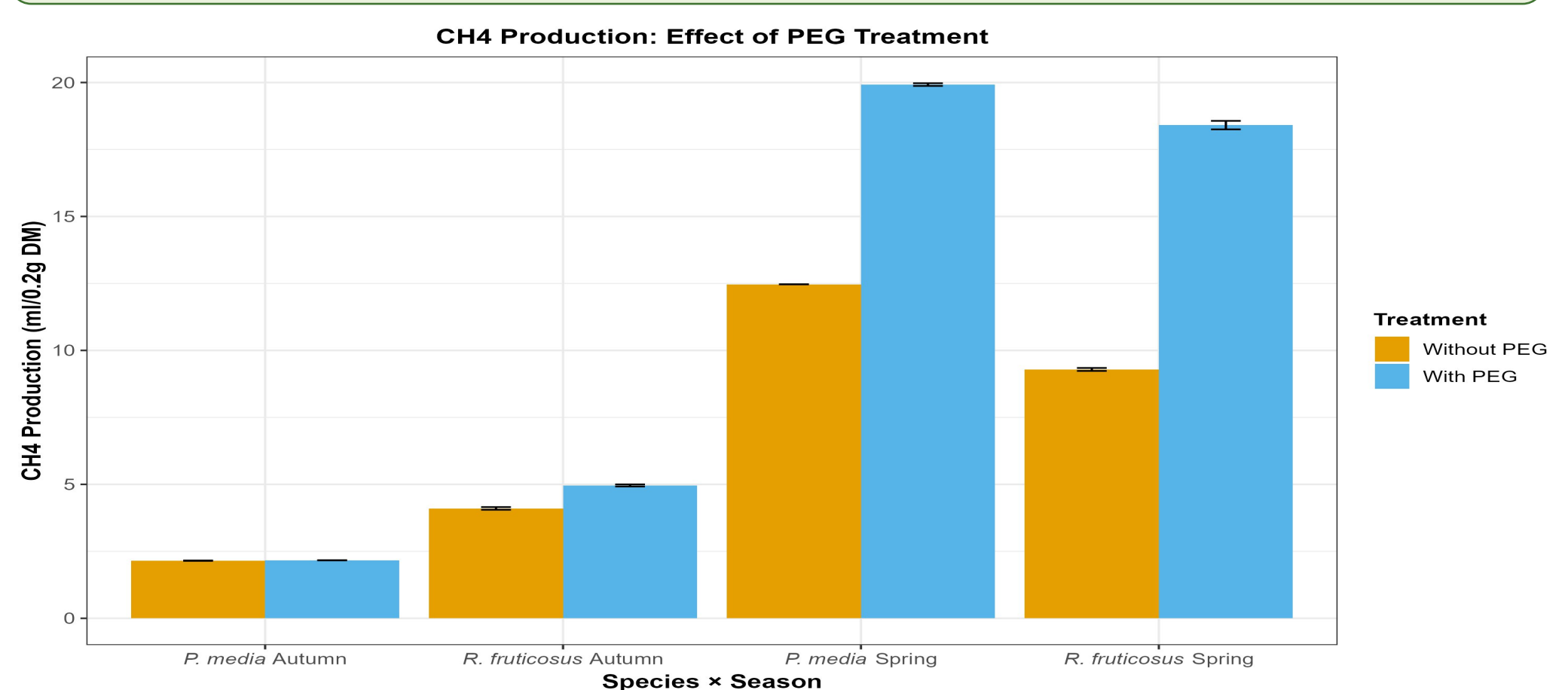


Figure4: *in vitro* methane production of *R. fruticosus* and *P. media* according to season (with and without PEG).

RESULTS & DISCUSSION

In vitro gas production kinetics

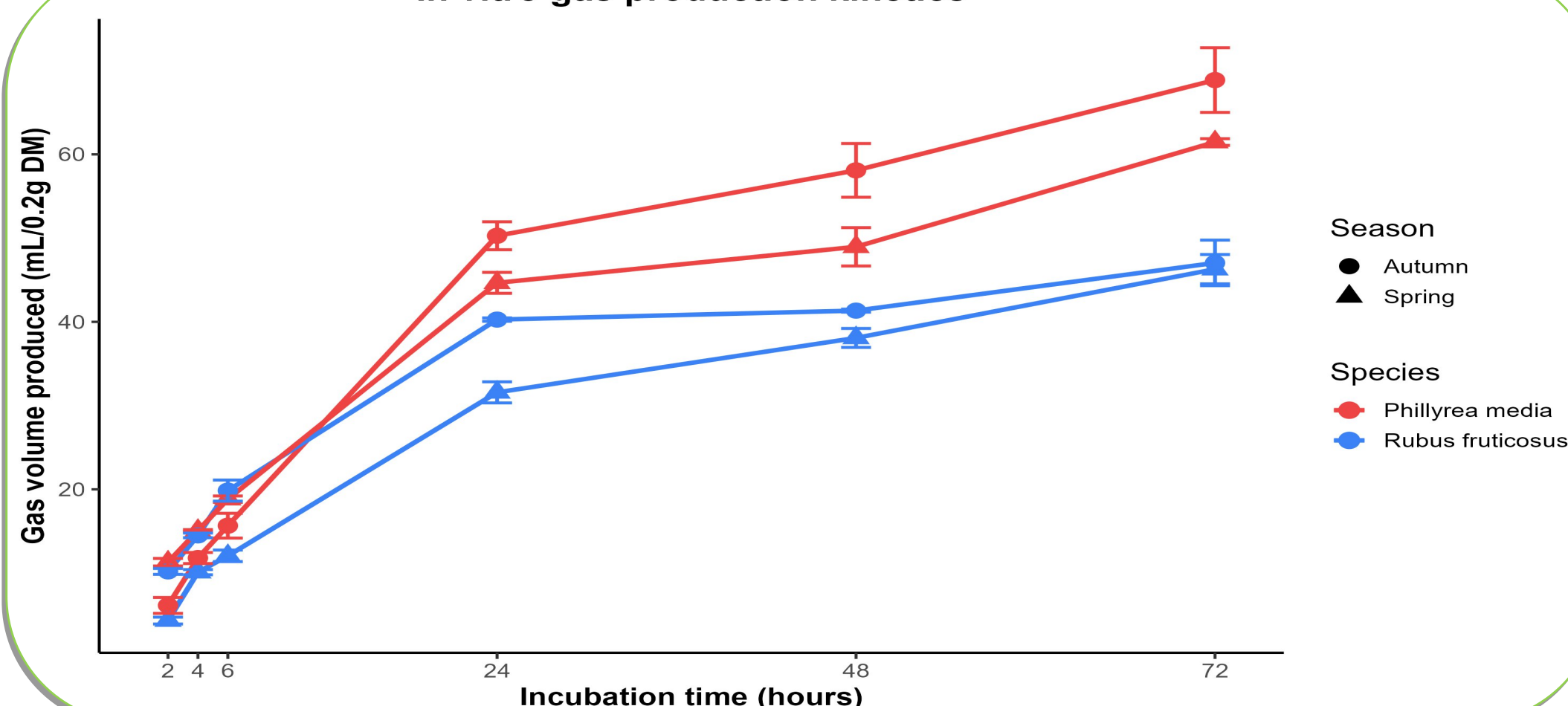


Figure2: Seasonal variation in *in vitro* gas production from *P. media* and *R. fruticosus* leaves

Gas and methane production differed significantly among plant species and seasons ($p < 0.001$). Total gas output peaked in autumn, whereas methanogenesis reached its maximum in spring. PEG addition increased both parameters, confirming the anti-methanogenic effect of condensed tannins. This effect was most pronounced in *Rubus fruticosus* during spring, while PEG had no significant influence in autumn ($p = 0.310$ to 0.950). Overall, tannins displayed a strong anti-methanogenic action while enhancing nutrient utilization, highlighting their potential for more sustainable and environmentally friendly livestock production.[3]

FUTURE WORK /CONCLUSION

These results highlight the importance of seasonal management of woody resources and reinforce the value of woody shrubs in extensive livestock systems, this could be achieved by promoting the supplementation of livestock with *Phyllirea media* in autumn, when its digestibility is higher, and by administering polyethylene glycol (PEG) to animals during both seasons for both species. Such management practices may enhance feed utilization efficiency and contribute to environmental protection.

REFERENCES

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