OXIDIZED MOLDSTIM UTILIZATION OF IN ON THE PEAR TREE (*PIRUS SATIVUS*)

UTILIZAREA MOLDSTIMULUI OXIDAT LA PĂR (*PIRUS SATIVUS*)

GRĂDINARIU G.[1], IUREA Dorina[2], MANGALAGIU I.I.[3], ISTRATE M.[1], MUNTEANU N.[1], MURARIU Aliona[1]

[1]University of Agricultural Sciences and Veterinary Medicine Iasi, Romania
[2]Institute of Biological Research Iasi, Romania
[3]"Al. I. Cuza" University of Iasi, Romania

Abstract. *Oxidized Moldstim is an semi-synthesis compound obtained by selective oxidation of Moldstim (a natural furostanol glycoside). The emphasis of this work was to test the new obtained oxidized Moldstim as grow up factor for pear trees (Pirus sativus). The influence of the plant compound with steroidal glycoside structure was studied on the plantation of pear trees. The treatments consisted in spraying the aqueous solution of oxidized Moldstim, at different doses and ways of using. The results of the experiments pointed out the positive effects of the influence of treatments with steroidal glycosides on the growth and quality development of apple trees.*

Key words: oxidized Moldstim, biostimulators of natural origin, oxidized Moldstim, pear tree.

Rezumat. *Glicozidele furostanolice, reprezinta substanțe naturale ce aparțin clasei saponinelor. Moldstimul, una dintre aceste glicozide, este întâlnită în semințele de Capsicum annuum si se obține prin extracție alcoolică din semințe de ardei iute. Este o substanță bioactivă de origine vegetală, având numeroase proprietăți biologice, în special proprietăți hemolitice, membranolitice, hipocolesterinemice, antitumorale si antifungice etc. Scopul acestei lucrări constă în promovarea acestui compus bioactiv si evaluarea activității sale biologice. (ca biostimulator de crestere si dezvoltare a plantelor de păr Pirus sativus). S-a studiat influența compusului natural cu stuctură glicozid - steroidică asupra unei plantații de meri. Tratamentele au constat în pulverizarea cu soluție apoasă de Moldstim oxidat, în diferite doze şi moduri de folosire. Rezultatele au subliniat efectele pozitive ale influentei tratamentelor cu glicozide steroidice asupra creşterii şi dezvoltării merilor.*

Cuvinte cheie: compus bioactiv, glicozidă steroidică furostanolică, biostimulatori naturali, Moldstim oxidat, plantație de păr.

INTRODUCTION

It is well known that the substances of synthetic origin are limited within the system of conventional growing or even forbidden in the systems of sustainable agriculture. That is why it appear as a necessity for agriculture to carry out studies on discovering and applying new bioactive substances of natural origin or, as a second alternative, to obtain semi – synthetic compounds by slightly structural modification of the natural one.

The investigations conducted at earlier stages (Kintea, 1987; Bobeiko Chintea, 1991; Tschesche and Gudwinski, 1975; Tschesche and Wulff, 1972; Kofler, 1972; Hostettmann, Marson, 1995) pointed out that some bioactive substances of natural origin, extracted from different plant organs (fruits, leaves, seeds, etc.), have variously biological activity.

The effect of endogenous steroid glycosides of furostanol series (melangoside, capsicoside, tomatoside and its sulphurized form) on growth processes was studied before (Volynets et al, 2002, Gonckharik et al 2004). The possibility of their application for stimulating seed germination, biomass growth and accumulation, generative organs development, fruit yield and quality was showed (Matevosyan et al, 2001). Antimicrobial and antioxidant activity of capsicoside was also evidenced.

Having in view the above considerations, we decided to obtain a new class of semi – synthetic steroidal compounds, obtained by selective oxidation of Moldstim (Iurea, 1996; 1999), a natural furostanol glycoside and to test the new obtained oxidized Moldstim as grow up factor for pear trees.

The goal of the present investigations is to study some bioactive substances, their application ways optimization. In terms of their biological activity evaluation, some physiological aspects were analyzed. Parameters characterized in the present study include photosynthetic pigments and soluble solids content.

MATERIALS AND METHODS

Investigations have been conducted in the experimental field of the Faculty of Horticulture from the University of Agricultural Sciences and Veterinary Medicine of Iaşi, Centre of Horticultural Research. As biological material, three years old pear trees (*Pyrus sativa)* varieties Curé and Untoasa Hardy (U. Hardy), grafted on the *Cydonia oblonga* BN 70 rootstock were used.

The product that belongs to BAS is Capsicoside - furostanolic steroidal glycoside of vegetal origin – in the 0.01%, 0.005%, 0.001%, 0.0001%, 0.00001% concentration variants. The treatment was made on 21st of April, 2009 by foliar pulverization with 500-600 l solution/ha.

In order to emphasize the efficiency of Capsicoside the leaves were sampled at 4-weeks after treatment. The content of photosynthetic pigments was determined in 80% acetone by the method described by Wellburn (1994). The content of chlorophyll chl. *a* and *b* and the sum of carotenoids in the leaves were determined, and the obtained results were presented in mg /g fresh matter. The measurements were carried out in five replicates on material collected from various trees and the results were presented as arithmetic means with the standard deviation.

RESULTS AND DISCUSSIONS

In our experiment, foliar Moldstim sprays increase *chlorophyll a* and total chlorophyll content on both cultivars leaves (table 1). This increasing was observed at 4 weeks after application it was more evident at Curé cultivar than U. Hardy cv.

The same pattern was observed in total chlorophyll content. Analyzing the results presented in fig no. 2 it can be observed that all applied concentrations on Curé cv. determined a more or less significant increase of the total photosynthetic pigments content. At U. Hardy cv., no effect of the Moldstim on increasing on *chlorophyll a* and total chlorophyll content, was observed at maximum and minimum concentrations. This difference may indicate that absorption rate of foliar-applied Moldstim and/or its translocation in plant was different on this two cultivars. Taking into account that fruit trees have the different ability to move macromolecular compound in the phloem (Brown and Hu, 1996), it seems that a lack effect of foliar application on U. Hardy cv. was related to restricted absorption rate by leaves of spur trees. This is possible because leaf area of spur tree at the beginning of the growing season is reduce (Bramlage and Thompson 1962)

There were no marked increases on *chlorophyll a* content as increasing Moldstim concentration from 0.005% to 0.01%. However, 0.005% Moldstim treatment leads to significantly high values of *total chlorophyll* and *chlorophyll a* content at both cultivars. Since a slight reduction in all chlorophyll types was noticed with the 0.01% application, the 0.005% concentration might represent a physiological threshold level beyond chlorophyll deteriorates.

As was the case of chlorophyll, 0.0001%-0.005% concentrations had as result a significantly high accumulation of dry matter in compare with control. No significant difference between control and the highest (0.01%) and the lowest (0.00001%) Moldstim concentrations on dry matter content were observed. The reduction on moisture content with Moldstim indicates an increase of dry matter, which raises the possibility of higher leaves photosynthetic activity.

Improving photosynthesis efficiency might possibly lead to the accumulation of assimilates which might explain the increase in dry matter content (fig.1).

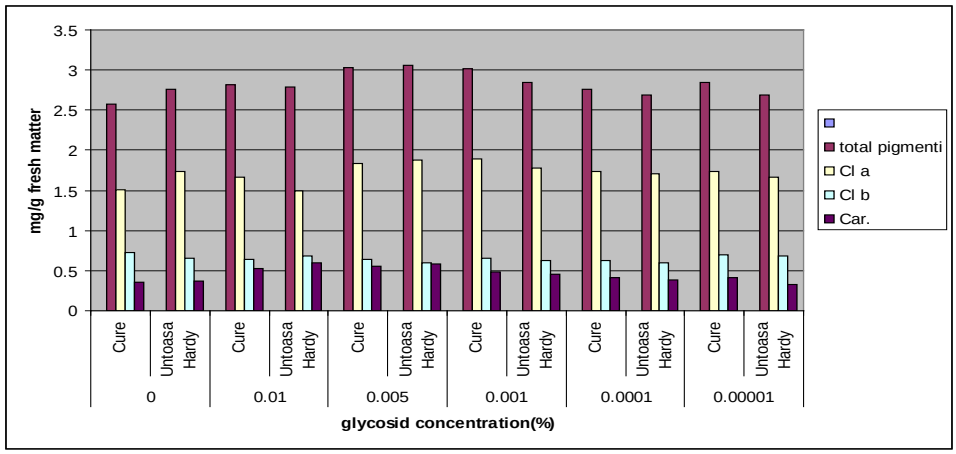

Fig. 1. The influence of Moldsim treatment on photosynthetic pigment and soluble solid content of *Curé* and *U. Hardy* pear cultivars

Table 1

Foliar chlorophyll, carotenoids and soluble solid levels in leaves of Pear cultivars treated with different concentration of Moldstim

Variant	Cultivar	Chl a (mg/g)	Chl b (mg/g)	Car. (mg/g)	Total pigm (mg/g)	Dif. to control (mg/g)	% and signif.	Chl a/ chl b	Dif. to control	% and signif.	Dry matter (mg/g)
0	Curé	1.51	0.72	0.35	2.58	0	100	2.10	0	100	**21.987**
	U. Hardy	1.73	0.66	0.37	2.76	0	100	2.62	0	100	**23.971**
0.01%	Curé	1.66	0.64	0.52	2.82	0.24	109^{x}	2.59	0.49	123^{xxx}	**23.562**
	U. Hardy	1.5	0.69	0.6	2.79	0.03	101	2.17	-0.45	83^{00}	**25.566**
0.005%	Curé	1.84	0.64	0.55	3.03	0.45	117	2.88	0.78	130^{xxx}	**33.687**
	U. Hardy	1.88	0.6	0.58	3.06	0.3	111^{x}	3.13	0.51	119^{xx}	**43.140**
0.001%	Curé	1.89	0.65	0.48	3.02	0.44	117^{xx}	2.91	0.81	128^{xxx}	**48.701**
	U. Hardy	1.78	0.62	0.45	2.85	0.09	103	2.87	0.25	110^{xx}	**41.039**
0.0001%	Curé	1.73	0.62	0.41	2.76	0.18	107^{x}	2.79	0.69	124^{xxx}	**42.552**
	U. Hardy	1.71	0.6	0.38	2.69	-0.07	97	2.85	0.23	109^{x}	**33.476**
0.00001%	Curé	1.73	0.7	0.41	2.84	0.26	110^{x}	2.47	0.37	113^{xx}	**25.984**
	U. Hardy	1.67	0.69	0.33	2.69	-0.07	97	2.42	-0.20	92^{0}	**26.980**
		Cure: LSD 5% = 0,09 mg/g; LSD 1% = 0,18 mg/g; LSD 0,1% = 0,24 mg/g H. Hardy: LSD 5% = 0,14 mg/g; LSD 1% = 0,30 mg/g; LSD 0,1% = 0,38mg/g						Cure: LSD 5% = 0,29 mg/g; LSD 1% = 0,62 mg/g; LSD 0,1% = 0,56 mg/g H. Hardy: LSD 5% = 0,17 mg/g; LSD 1% = 0,33mg/g; LSD 0,1% = 0,38mg/g			

This hypothesis may be confirmed by the fact that Moldstim treatment improves the *chlorophyll a/chlorophyll b* ratio. In normal plant growth the efficient photosynthesis is at the approximate ratio of *chlorophyll a/chlorophyll b* in the order of 3:1. In our experiment the ratio of *chlorophyll a /chlorophyll b* of the control trees was 2,10 on Curé cv. and 2,62 on U. Hardy cv. This ratio was based on increased of *chlorophyll b* content at initial growing stage of the trees. A possible explanation for the elevated *chlorophyll b* content of the trees, in May, is that the trees were in such a stressful condition due of their intensive growth that only a small amount of new *chlorophyll a* were being produced. *Chlorophyll a* is the more unstable form and would decrease, while the more stable *chlorophyll b* would accumulate. The treatment with 0.005%-0.0001% concentration of Moldstim stimulated the *chlorophyll a* synthesis, and as consequence the ratio of *chlorophyll a/chlorophyll b* was improved.

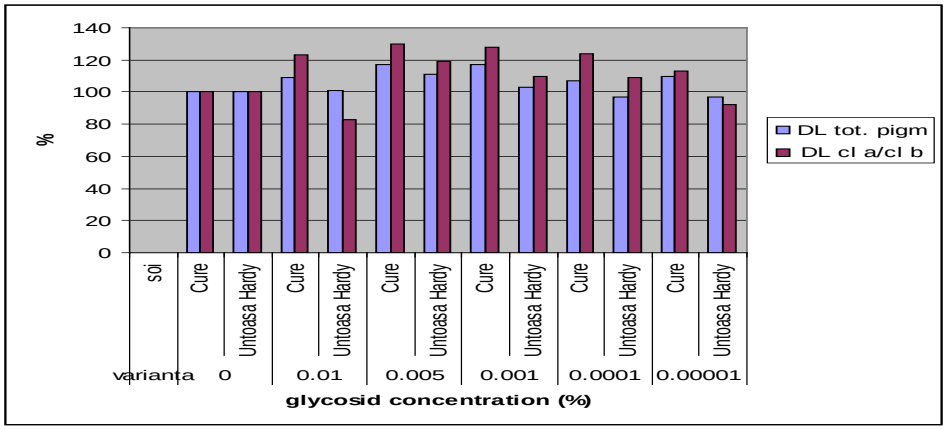

Fig. 2. Chlorophyll a/chlorophyll b ratio in the lives of Curé and U. Hardy cultivars treated with Moldstim

CONCLUSIONS

1. Foliar Moldstim sprays increase *chlorophyll a* and total chlorophyll content on both cultivar's leaves and as a consequence improves the *chlorophyll a/chlorophyll b* ratio;

2. Treatments with 0.001%-0.005% concentration of Moldstim demonstrate the highest biological effect at both cultivars. There were no marked increases on total pigments or soluble solid content as increasing Moldstim concentration from 0.005% to 0.01%.

3. There are differences on the optimal concentrations of Moldstim treatment between studied cultivars. This differences may indicate that absorption rate of foliar-applied Moldstim is genotypic dependent process.

REFERENCES

1. **Bobeiko, V.A., Chintea, P.C., 1991** – *Spirosolanobâe Glicotidî.* Ştiința Kisineb.
2. **Bramlage W.J. and A.H. Thompson, 1962** - *The effects of early-season sprays of boron on fruit set, color, finish, and storage life of apples*. Proc. Amer. Soc. Hort. Sci. 80:64–72.
3. **Brown Patrick H., Hening Hu., 1996** - *Phloem mobility of compounds is species dependent: Evidence for phloem mobility in sorbitol-rich species.* Annals of Botany 77:497-505.
4. **Croitoru Florica et al., 1988** - *Biostimulatorii şi influența acestora în cultura legumelor.* Ministerul Agriculturii, Bucureşti
5. **Gonckharik N.N., Volynets A.P., Kintia P.K**., **2004** - *The after –effect of steroid glycosides on seed quality and seedling growth on wheat (Triticum ae. stivum L.).* Vestsi Natsy Acad Belarus, Ser. Biyala Navuk 23-26
6. **Hostettmann K., Marston M.**, **1995** - *Saponins. Chemistry and Pharmacology of Natural Products*, Cambridge University Press, New York, 548 p.
7. **Iurea Dorina, Chintea P.C, Uglea C.V**., 1996 - *Modified steroidal glycosides with potential Biological Activity, in Saponins Used in Traditional and Modern Medicine. Ed. by Waller and Yamasaki,* Plenum Press, New York, 404, p. 111 - 116.
8. **Iurea Dorina, Chintea Pavel, Panaitescu Luminita, Mereanu V., Uglea C., 1999** - *Oxidized Capsicozid with antitumoral properties*. Patent no.1435 / 16.II. MD.
9. **Kofler L., 1972** - *Die Saponine.* Julius Springer Verlag, Vienna, 527 p
10. **Shukanov V.P.; Volynets A.P.; Kintya P.K.; Prokhorchik R.A.; Pshenichnaya L.A.; Morozik G.V.; Manzhelesova N.E., 1997** - *Growth of clover vegetative organs treated with steroid glycosides* (National Academy of Sciences of Belarus, Minsk (Belarus). Institute of Experimental Botany) Publication Date (Oct-Dec 1997)
11. **Tschesche R., Wulff G., 1972** - *Chemie und Biologie der Saponine.* Prog. Chem. Org. Nat. Prods., 30, p. 462 - 606
12. **Tschesche R., Gudwinski H., 1975** - *Steroidsaponine mit mehr als einer Zuckerkette, X.Capsicozid, ein bisdesmosidisches 22-Hydroxyfurostanol- Glycosid aus dem Samen von Capsicum annuum L*. Chem. Ber., 108, p. 265 - 272