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LONGEVITY AND HEALTHINESS OF OAT (*AVENA SATIVA* L.) SEEDS TREATED WITH PLANT EXTRACTS

Bronisława Sas-Piotrowska, Wojciech Piotrowski, Roksana Kaczmarek-Cichosz

Technical University Of Koszalin
Racławicka 17, 75-620 Koszalin
e-mail: wojpiotr@tu.koszalin.pl

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Abstract: In *in vivo* experiments the natural biologically active substances, which may reduce the application of chemical plant protection pesticides were examined. As dressing preparations water extracts (macerations, infusions) prepared from various parts of 39 plant species were used. For dressing non-disinfected seeds of two varieties of oat: Akt with naked seeds and Bajka with chaffed seeds were used. The experiment was conducted as a filter paper test, germination viability (I date) and germination capacity (II date) as well as healthiness of the seeds were determined. A significant differentiation of the effect of the extracts depending on extracts' origin (plant), mode of their preparation and of interaction between these factors was revealed.

Key words: plant protection, plant extracts, oat, longevity and healthiness of seeds

INTRODUCTION

Results of earlier researches fungicidal activity of extracts of *Polygonaceae* plants have shown that the extracts restricted in vitro growth and development of many species of pathogens (Sas-Piotrowska and Piotrowski 1995, 1997).

Continuing these researches, in vivo experiments were established, in which the macerations and infusions from 20 medicinal plant species were applied for dressing seeds of wheat, triticale and rye (Sas-Piotrowska et al. 2004a). The authors proved that longevity and healthiness of seeds of the mentioned plants depended both on the origin of the infusion and the way of its preparation.

In the present work the scope of plants being a source for water extracts was widened. The aim of the work was to search new biologically active substances that may reduce the use of chemical plant pesticides and protect the plant environment against excessive use of chemicals.

MATERIAL AND METHODS

In in vivo experiment the activity of water extracts on longevity and healthiness of seeds of oat (*Avena sativa* L.) was examined. The materials under investigation were:

- water extracts (macerations, infusions) made from various parts of 39 plant species:

  1. *Acorus calamus* L. – rhizome; 2. *Aesculus hippocastanum* L. – bark; 3. *Aesculus hippocastanum* L. – flowers; 4. *Allium sativum* L. – bulb; 5. *Archangelica officinalis* Hoffm. – roots; 6. *Arctium lappa* L. – roots; 7. *Artemisia absinthium* L. – herb; 8. *Artemisia vulgaris* L. – herb; 9. *Betula verrucosa* Ehrh. – leaves; 10. *Calendula officinalis* L. – flowers; 11. *Camelina sinensis* L. – leaves; 12. *Carum carvi* L. – fruit; 13. *Coriandrum sativum* L. – fruit; 14. *Crataegus oxyacantha* L. – flowers; 15. *Equisetum arvense* L. – herb; 16. *Frangula alnus* Mill. – bark; 17. *Hyssopus officinalis* L. – herb; 18. *Inula helenium* L. – roots; 19. *Juglans regia* L. – leaves; 20. *Juniperus communis* L. – fruit; 21. *Lavandula vera* L. – flowers; 22. *Levisticum officinal*e L. – roots; 23. *Linum usitatissimum* L. – seeds; 24. *Marrubium vulgare* L. – herb; 25. *Matricaria chamomilla* L. – inflorescence; 26. *Melissa officinalis* L. – leaves; 27. *Mentha piperita* L. – leaves; 28. *Origanum majorana* L. – herb; 29. *Pinus sylvestris* L. – young sprouts; 30. *Quercus robur* L. – bark; 31. *Ribes nigrum* L. – leaves; 32. *Rosa canina* L. – fruit; 33. *Salix alba* and *S. purpurea* L. – bark; 34. *Sambucus nigra* L. – flowers; 35. *Saponaria officinalis* L. – roots; 36. *Satureja hortensis* L. – herb; 37. *Taraxacum officinale* Web. – roots; 38. *Urtica dioica* L. – leaves; 39. *Verbascum thapsiforme* L. – flowers; 40. *Zea mays* L. – stigmas. The above used numbering is the same as that for figures.

  The extracts were prepared as follows:
  - maceration – 5 g of dried material was inundated in 100 ml of sterile cold water and remained under covering over 24 hours in a temperature of 20°C;
  - infusion – 5 g of dried material was inundated in 250 ml of boiling water and remained under covering for 30 minutes.

  After filtration the extracts were used for dressing the seeds of oat.
- non-disinfected seeds of oat:
  - variety Akt with naked seeds (*Avena sativa* L. *var. nuda*);
  - variety Bajka with chaffed seeds (*Avena sativa* L.).

The seeds were dressed by wetting and shaking in laboratory dressing device and remained for 20 hours in ambient temperature. As control object were used the seeds of oat treated with distilled water.

The experiment was performed as a filter paper test according to Polish Standard PN-R-65950 with estimation of the following parameters:

- germination viability – evaluation after 5 days (I date);
- germination capacity- evaluation after 10 days (II date).

As criteria of the evaluation were taken: number of normally germinated seeds; number of non-normally germinated seeds; number of non-germinated seeds, number of infected seeds. In the paper were given and discussed only the data concerned impact of substances contained in plant extracts on the number of normally germinated and emerged seeds and their healthiness (infection).

The obtained results were subjected to statistical analysis using the method of analysis of variance with a single classification (p=95%), separately for each variety, date of research and evaluation criterion. For comparison of the results obtained for the evaluated varieties, dat and criteria of evaluation applied were correlation (r) and variability (V%) coefficients. In figures the results are calculated in percentages in relation to the control object.

RESULTS

The conducted in vivo researches have shown a statistically significant differentiation between water extracts' effect on germination viability and capacity of the seeds for two varieties of oat. The method of water extracts' preparation also significantly differentiated the obtained results. No significant differentiation was stated solely for evaluation of infection for Bajka variety at II date.

Naked seed oat, variety Akt

Analysis of variance proved a significantly differentiated effect of 40 extracts and methods of their preparation on longevity and healthiness of naked seed oat.

Germination viability (I date) of the seeds was stimulated by 24 plant extracts (60 %). A range of their effect varied from +0.1% to +24.1% (Fig.1A). Significantly most strongly germination viability was stimulated by extracts from flowers of

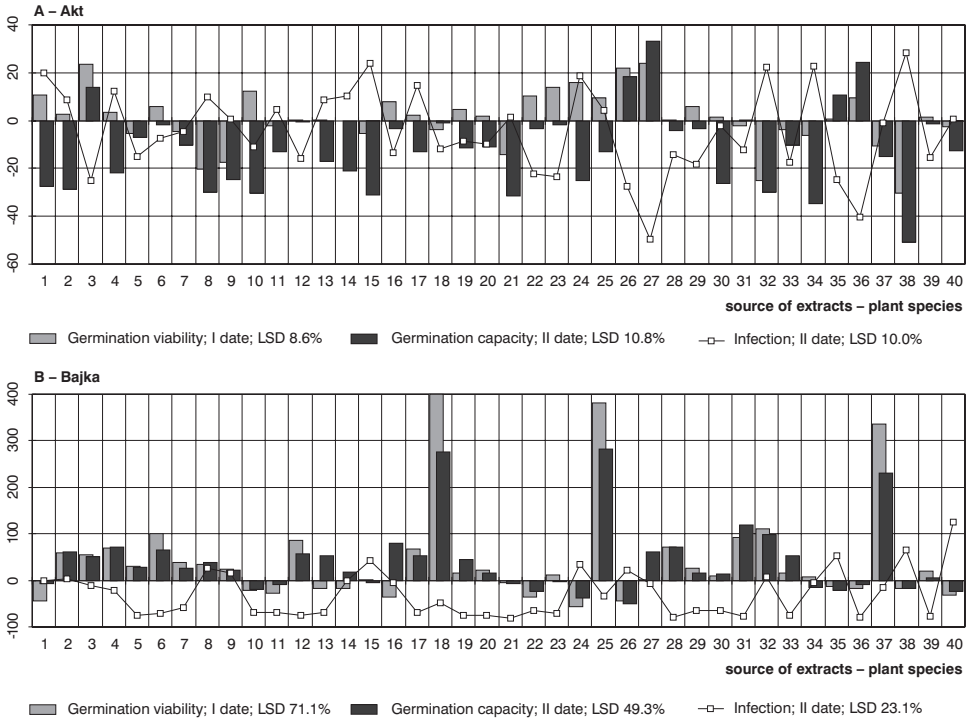

Fig. 1. A mean influence of the extracts on oat seed vitality and healthiness (deviation from control; %)

A. hippocastanum (+23.5%), leaves of *M. officinalis* (+22.1%), herbs of *M. vulgare* (+16.1%), seeds of *L. usitatissimum* (+14.0%) and flowers of *C. officinalis* (+12.2%).

Negative influence on seed germination was recorded for extracts from leaves of *U. dioica* (–30.3%), from fruits of *R. canina* (–25.2%), from herbs of *A. vulgaris* (–20.4%), from leaves of *B. verrucosa* (–17.4%) and from flowers of *L. vera* (–14.4%).

From among two methods of extract preparation more favourable on seed germination had macerations (Fig. 2, I date). When compared with the control object such influence revealed biologically active substances present in 27 macerations, what presented 67.5%. The range of their action varied from +0.7% to +31.0%. Germination viability of the seeds was influenced mostly by macerations from flowers of *A. hippocastanum* (+31.0%), from leaves of *M. officinalis* (+24.5%) and *M. piperita* (+23.3%), from herb of *M. vulgare* (+23.7%) and *E. arvense* (+21.7%), from flowers of *C. oxyacantha* (+21.7%) and from inflorescences of *M. chamomilla* (+21.7%).

The examined extracts influenced as well healthiness of the seeds. Regardless of the method of preparation, 24 extracts (60%) inhibited the development of pathogens on a seed surface. Upon their influence a number of infected seeds were reduced from –1.8% to –66.6%. The strongest seed protection against infestation by bacteria and fungi ensured extracts from leaves of *M. piperita* (–66.6%), *U. dioica* (–56.3%) and *M. officinalis* (–50.6%). Infection of the seeds was stimulated by 40% of extracts, and particularly from herb of *A. vulgaris* (+39.1%), from fruits of *R. canina* (+36.8%), from flowers of *L. vera* (+24.6%), from herb of *O. majorana* (+24.6%).

From among two methods of extract preparation the macerations more effectively reduced seed infection. Such action revealed 70% of macerations (a range of influence from –5.1% to –70.9%) and 60% of infusions with a range of influence between –1.3% and – 62.4%. Particularly good action showed maceration from leaves of *M. piperita* (–70.9%), from herb of *E. arvense* (–61.5%), from leaves of *U. dioica* (–56.8%), from herb of *M. vulgare* (–53.0%) and infusions from leaves of *M. piperita* (–62.4%), *U. dioica* (–55.8%) and *M. officinalis* (–52,1%), from flowers of *C. officinalis* (–44,5%), from roots of *I. helenium* (–41.7%).

On the other hand the infection of seeds was stimulated by macerations from flowers of *L. vera* (+50.4%), from fruits of *R. canina* (+39.1%), from herb of *O. majorana* (+28.8%) and from roots of *T. officinale* (+26.9%) and infusions from herb of *A. vulgaris* (+62.6%), from leaves of *B. verrucosa* (+53.2%), from herb of *A. absinthum* (+34.4%), from fruits of *R. canina* (+34.4%) and from flowers of *C. oxyacantha* (+30.7%).

Germination capacity of seeds (II date) was stimulated by 15% and inhibited by as much as 85% of used extracts. The range of their action varied respectively from +0.1% to +33.3% and from –0.4% to –50.6% (Fig. 1A). A stimulating action was shown by extracts from leaves of *M. piperita* (+33.3%), from herb of *S. hortensis* (+24.4%), from leaves of *M. officinalis* (+18.3%) and inhibiting action by extracts from leaves from *U. dioica* (–50.6%), from flowers of *S. nigra* (–34.6%) and *L. vera* (–31.3%) and herb of *E. arvense* (–31.1%).

From two forms of prepared extracts, the number of normally germinated seeds was significantly mostly affected (87.5% of all used infusions) (Fig. 2, II date). There were first of all the infusions prepared from herb of *E. arvense* (–62.5%), from flowers of *C. oxyacantha* (–49.3%), from herbs of *A. vulgaris* (–49.3%), *A. absinthum* (–48.8%) and *M. vulgare* (–40.7%).

In a case of macerations a half of their number had a stimulating influence on germination of naked seed oat and the other half inhibiting influence. To the macerations with stimulating action belonged extracts from flowers of *A. hippocastanum* (+49.0%), from leaves of *M. piperita* (+34.3%), from herb of *S. hortensis* (+33.3%), *A. absinthium* (+28.2%), from leaves of *M. officinalis* (+25.2%) and to the inhibiting ones belonged macerations from leaves of *U. dioica* (–69.1%), from flowers of *S. nigra* (–41.7%), from rhizomes of *A. calamus* (–35.1%) and from flowers of *C. officinalis* (–32.1 %) and from fruits of *R. canina* (–31.1%).

Likewise in II date of examination healthiness of the seeds of naked seed oat depended on plant which was a source of the extract (Fig. 1A).

From among 40 extracts only 57.5% reduced the development of pathogens on a seed surface. Their influence ranged from –0.9% to –49.6%. The strongest action against pathogen infection was revealed for extracts from leaves of *M. piperita* (–49.6%), from herb of *S. hortensis* (–40.2%), from leaves of *M. officinalis* (–27.5%). To extracts stimulating the development of seed microflora belonged 17 extracts

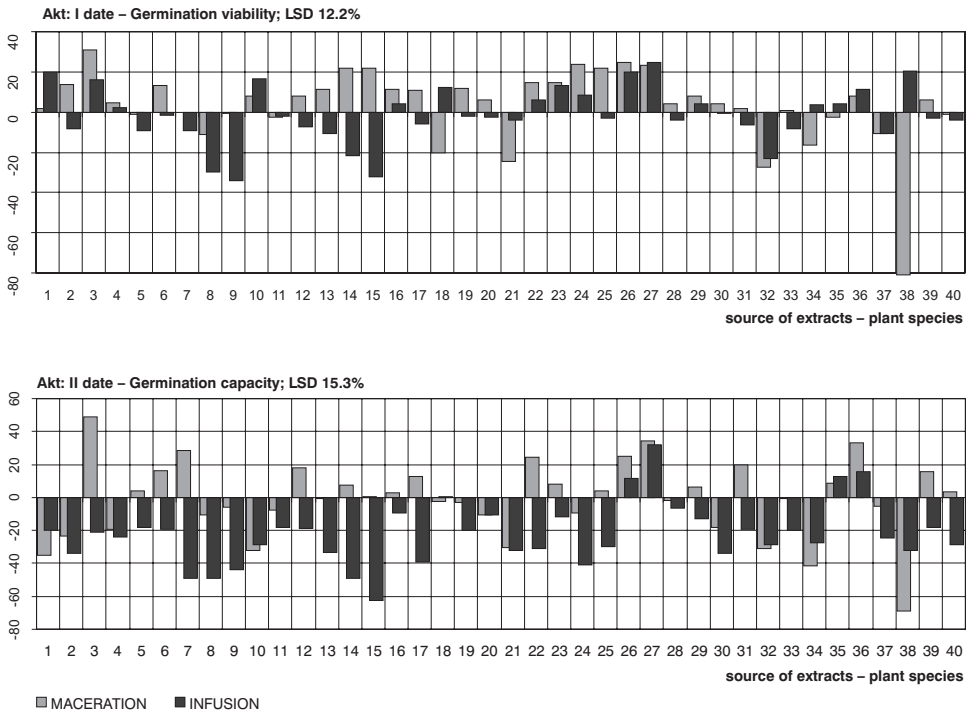

Fig. 2. Oat seed vitality of Akt variety depending on a source and preparation mode of the extracts (deviation from control; %)

(42.5%), and their activity ranged from +0.7% to +28.5%. These were extracts from leaves of *U. dioica* (+28.5%), from herb of *E. arvense* (+24.0%), from flowers of *S. nigra* (+22.8%), from fruits of *R. canina* (+22.4%) and from rhizomes of *A. calamus* (+20.0%).

From two forms of water extracts the macerations reduced more significantly seed infection than the infusions did. Such action revealed 75% of macerations and 42% of infusions. The range of their action varied respectively from –1.6% to –55.8% and from –1.2% to –46.3% (Fig. 4A). There were first of all macerations from flowers of *A. hippocastanum* (–55.8%), from leaves of *M. piperita* (–52.9%), from roots of *L. officinale* (–48.2%), from herb of *S. hortensis* (–48.2%), from seeds of *L. usitatissimum* (–41.6%), and infusions from leaves of *M. piperita* (–46.3%), from herb of *S. hortensis* (–32.2%) and from roots of *S. officinalis* (–27.5%). On the other hand the infection of oat seeds increased when they were treated with macerations from flowers of *S. nigra* (+34.1%), from leaves of *U. dioica* (+31.8%), from fruits of *R. canina* (+27.6%) and rhizomes of *A. calamus* (+26.6%) and with infusions from herb of *H. officinalis* (+57.7 %), *E arvense* (+52.5%), *M. vulgare* (+35.6%), from flowers of *C. oxyacantha* (+34.6%) and from herb of *A. vulgaris* (+27.6%).

Chaffed seed oat, variety Bajka

Germination viability of seeds (I date) of this variety was stimulated by 26 (65%) of all used plant extracts (Fig. 1B). The range of their activity varied in comparison to the control from +1.7% to 400%. A normal seed germination was stimulated mostly by extracts from roots of *I. helenium* (+400%), *T. officinale* (+335%) and inflorescences of *M. chamomilla* (+382%).

The method of extract preparation also caused a significant differentiation of results (Fig. 3, I date). The most favourable action on seed germination showed biologically active substances contained in 28 infusions (70% of all used infusions), and particularly from roots of *I. helenium* (+880%) and *T. officinale* (+740%). From macerations such action revealed only 42.5% of their number. Those were macerations from inflorescences of *M. chamomilla* (+783%) and from fruits of *R. canina* (+240%).

The germination of oat seeds of variety Bajka was inhibited by extracts from herb of *M. vulgare* (–56.7%), from leaves of *M. officinalis* (–43.3%), from roots of *L. officinale* (–36.7%), from leaves of a red tea Pu-Erh *C. sinensis* (–26.7%) and from flowers of *C. officinalis* (–21.7%).

The examinations of seeds of variety Bajka showed that the majority of extracts reduced microflora development on a seed surface. From 40 extracts merely 7 stimulated an infection. Those were extracts from fruits of *R. canina* (+58.9%), from leaves of *M. piperita* (+21.6%) and *U. dioica* (+18.4%) and from roots of *S. officinalis* (+10.3%), from flowers of *A. hippocastanum* (+8.7%), from inflorescences of *M. chamomilla* (+7.1%) and herb of *E. arvense* (+3.8%). The seed infection was mostly reduced by extracts from herb of *S. hortensis* (–77.3%), from flowers of *L. vera* (–70.8%), from herb of *O. majorana* (–64.3%), from fruits of *C. sativum* (–62.7%), from seeds of *L. usitatissimum* (–62.7%) and from fruits of *J. communis* (–61.1%).

When compared the activity of macerations with that of infusions made from various plants on seed healthiness it was proved that the majority of them, and namely 80% of macerations and 87.5% of infusions significantly reduced development of pathogens. The range of their activity in relation to seed microflora varied for macerations from –9.2% to –77.3% while that for infusions from –12.4% to –80.5%.

The number of infected seeds was the smallest when they were treated with macerations from bulbs of *A. sativum* (–77.3%), from herb of *S. hortensis* (–74.0%), from seeds of *L. usitatissimum* (–74.0%), from fruits of *C. carvi* (–74.0%) and with infusions from herb of *S. hortensis* (–80.5%), from flowers of *L. vera* (–74.0%), from shoots of *P. sylvestris* (–74.0%), from fruits of *C. sativum* (–74.0%).

A positive effect on germination capacity (II date) on the seeds of variety Bajka exerted chemical substances contained in extracts from 26 plant species, this made up 65% of all extracts used (Fig. 1B). The range of their activity varied from +6.4% to + 281.5%. Significantly positively influenced seed germination capacity substances contained in extracts from inflorescences of *M. chamomilla* (+281.6%), from roots of *I. helenium* (+276.9%) and *T. officinale* (+230.7%) and leaves from *R. nigrum* (+118.5%).

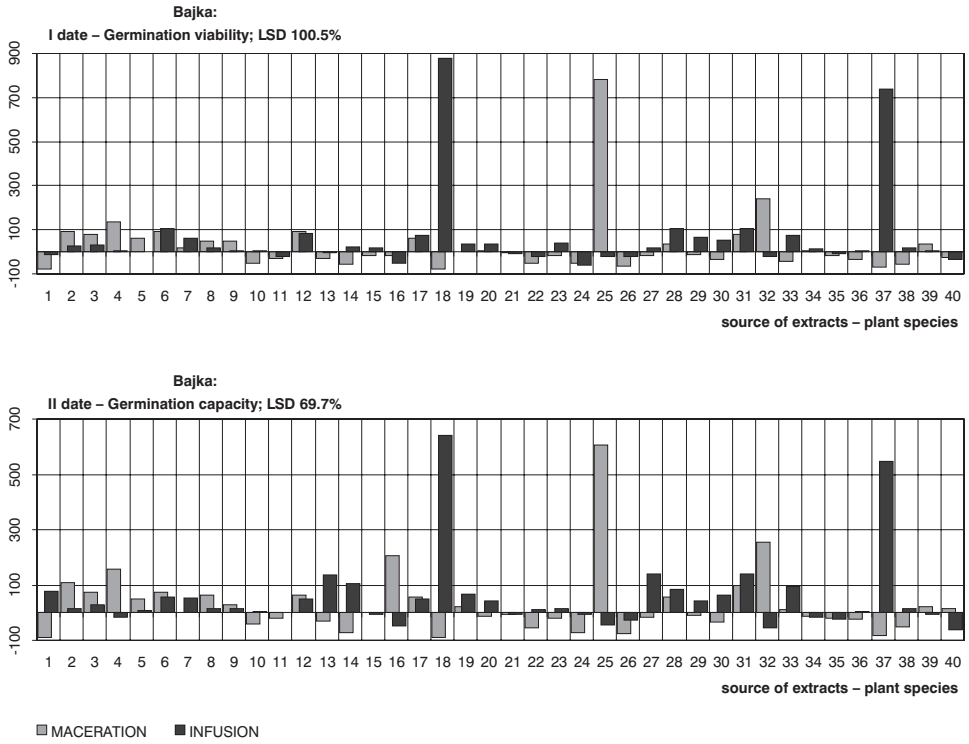

Fig. 3. Oat seed vitality of Bajka variety depending on a source and preparation mode of the extracts (deviation from control; %)

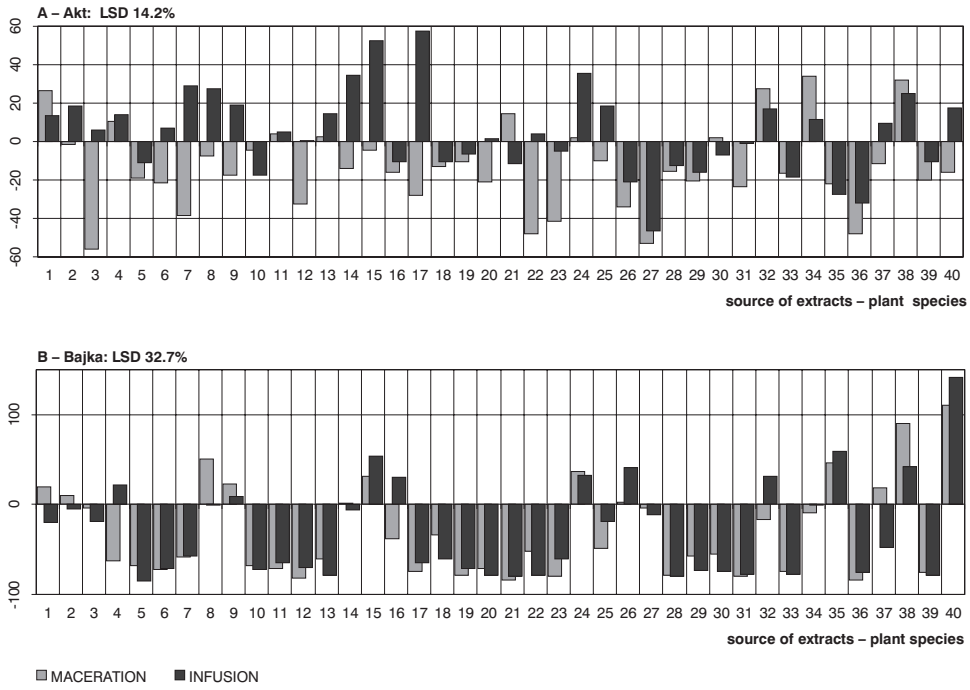

Fig. 4. Oat seed healthiness depending on a source and preparation mode of the extracts (deviation from control;%)

Seed germination of this variety was inhibited by 14 extracts (35% of all used). The range of their activity varied from –2.9% to –50.3%. Such action was revealed mostly in a case of extracts from leaves of *M. officinalis* (–50.3%), from herb of *M. vulgare* (–38.7%), from stigmas of *Z. mays* (–22.5%), from roots of *L. officinale* (–22.5%) and *S. officinalis* (–21.4%).

Seed germination capacity also depended significantly on the method of extract preparation (Fig. 3, II date). When compared to macerations (45.0%) infusions more favourably influenced germination capacity (67.5%). Among infusions there were extracts from roots of *I. helenium* (+642.4%) and *T. officinale* (+545.2%), from leaves of *M. piperita* (+140.5%) and *R. nigrum* (+140.5%) and from fruits of *C. sativum* (+138.8%), and among macerations there were extracts from inflorescences of *M. chamomilla* (+607.7%), from fruits of *R. canina* (+253.8%), from bark of *F. alnus* (+207.6%), from bulbs of *A. sativum*, (159.0%) from bark of *A. hippocastanum* (+108.1%).

It was observed as well that some infusions (32.5%) and particularly macerations (55.0%) reduced germination capacity. By such action were distinguished infusions from stigmas of *Z. mays* (–60.7%), from fruits of *R. canina* (–56.0%) from bark of *F. alnus* (–49.1%) and macerations from roots of *I. helenium* (–88.4%) and *T. officinale* (–83.8%) and from rhizomes of *A. calamus* (–88.4%).

The examined extracts influenced differently seed healthiness. As many as 30 water extracts (75%) from 40 of examined ones reduced efficiently seed infection

(Fig. 1B). Their favourable activity varied from –0.2% to –81.6%. To extracts the most effectively reducing infection belonged extracts from flowers of *L. vera* (–81.6%), from herb of *S. hortensis* (–79.4%) and *O. majorana* (–78.8%), from leaves of *R. nigrum* (–78.3%), from flowers of *V. thapsiforme* (–76.7%). Seed treatment with extracts from stigmas of *Z. mays* (+126.2%), from leaves of *U. dioica* (+66.0%), from roots of *S. officinalis* (+53.0%), from herb of *E. arvense* (+42.7%) and *M. vulgare* (+34.5%) stimulated their infection.

The infection of seeds treated with extracts depended on their origin (plant) and on method of their preparation. A majority of the extracts (70%) of macerations (a range from –3.4% to –83.7%) as well as 75% of infusions (a range varied from –0.2% to –84.8%) reduced the infection (Fig. 4B)

The most effective were macerations from herb of *S. hortensis* (–84.7%), from flowers of *L. vera* (–83.7%) and from seeds of *L. usitatissimum* (–79.4%), and among of infusions those from roots of *A. officinalis* (–84.8%), from flowers of *L. vera* (–79.4%) from herb of *O. majorana* (–79.4%), from fruits of *J. communis* and of *C. sativum* (–78.3%), from flowers of *V. thapsiforme* (–78.3%), from roots of *L. officinale* (–78.3%). On the other hand the infection of seeds was stimulated by macerations from stigmas of *Z. mays* (+110.5%), from leaves of *U. dioica* (+89.9%), from herb of *A. vulgaris* (+50.8%) and infusions from stigmas of *Z. mays* (+141.9%), from roots of *S. officinalis* (+59.5%) and from herb of *E. arvense* (+54.1%).

Making comparison of action of 40 water extracts on germination viability and capacity of both oat varieties, a significant positive correlation was stated. Values of a correlation coefficients amounted to: for chaffed seed variety Bajka $r = 0.943^{**}$, for naked seed variety Akt $r=0.546^{**}$ by critical value of $r = 0.314$. A response variability for both varieties expressed by variability coefficient (V%) was on the other hand different and amounted to: for Bajka variety 73.1% (I date) and 53.0% (II date), and for Akt variety respectively 20.2% and 19.4%. The values of the coefficients indicate that the seeds of Bajka variety were characterized by a greater variability and by a greater response to the extracts used than those of Akt variety.

The influence of water extracts on oat seeds infection in I and II date of evaluation was significantly consistent only for Bajka variety ($r = 0.514^{**} >$ r critical). For Akt variety such significance was not stated, but a positive correlation ($r = 0.242$) indicates a similar tendency as for Bajka variety, that is the seed infection depended on plant as an origin of water extracts.

The response of the seeds of tested oat varieties on extracts made from various species of medicinal plants was significantly consistent ($r= 0.364^{*} >$ r critical). Variability coefficient (V%) calculated for comparison of healthiness of both varieties in two dates of evaluation was greater for Bajka variety and amounted to 45.4% (I date) and 72.5% (II date). For Akt variety these values amounted to 28.2% and 18.8%, respectively.

Furthermore it was stated that the more strongly the examined extracts reduced seed infection, the greater was seed vitality. However correlation coefficient for these features was significant only for Akt variety (I date $r = –0.474^{**}$, II date $r = –0.893^{**} > 0.314$). For Bajka variety only some tendency in the same direction was evident (I date $r= –0.185$; II date $r= –0.170$).

DISCUSSION

In the last years researches on possibility to make use of natural biologically active substances occurring in medicinal plants for plant protection against various plant pests have been undertaken (Augustyniak et al. 1997; Kmitowa et al. 1997; Saniewska et al. 2001, 2003; Stompor-Chrzan 2003, 2003/1; Sas-Piotrowska and Piotrowski 1995, 1997; Sas-Piotrowska et al. 2004a, 2004b). Thanks to investigations carried out in many scientific centres several environmental safe biopesticides (i.e. Bioczos, Biosept 33SL, Aldared, Novodor) were registered. However they are not entirely effective to protect plants against pathogens. Therefore it is a necessity to search the new, effective and safe for agriecosystems formulations.

In our researches concerned with 40 water extracts used for seed dressing of oat significant differences in their action on seed longevity and healthiness were stated. Sometimes the response of examined varieties was different as well. The seed longevity of Akt variety was stimulated by extracts from leaves of *M. piperita* and *M. officinalis*, from herb of *S. hortensis* and of Bajka variety from roots of *I. helenium*, *T. officinale*, from inflorescences of *M. chamomilla*, from fruits of *R. canina* and from leaves of *R. nigrum*. The seed longevity of Akt variety was inhibited by leaves from *U. dioica*, from flowers of *L. vera*, *S. nigra*, from herb of *E. arvense* and of Bajka variety by leaves from *M. officinalis*, from herb of *M. vulgare*, from roots of *L. officinale* and *S. officinalis*.

The researches of Stompor-Chrzan (2003) carried out in vitro on impact of many extracts on *Alternaria alternata* have shown that growth of this fungus was inhibited by extracts from *S. hortensis*, *L. officinale*, *A. officinalis*, *C. sativum* and *R. nigrum*. On the other hand Augustyniak et al. (1997) and Kmitowa et al. (1997) report about inhibiting impact of extracts from *U. dioica*, *E. arvense* and *A. absinthium* on colonies growth and sporulation of entomopathogenic fungi. In our researches oat seed infection was reduced by other extracts, i.e. from leaves of *M. piperita* and *M. officinalis* (Akt variety) and from herb of *S. hortensis*, from flowers of *L. vera* and from herb of *O. majorana* (Bajka variety). On other hand the extracts from leaves of *U. dioica*, from herb of *E. arvense* and from roots of *S. officinalis* increased inhabiting seeds of Bajka variety by microorganisms. In a case of Akt variety these were extracts from fruits of *R. canina*, from herb of *A. absinthium* and *E. arvense*, from leaves of *U. dioica*.

A favourable influence on healthiness of pea seedlings obtained Stompor-Chrzan (2003/1) by a seed dressing with an extract formulation made from *A. hippocastanum* and leaves of *R. nigrum*. Similar results were obtained with an extract from *A. hippocastanum*, *A. sativum* and *S. officinalis* in relation to cereal seeds (Sas-Piotrowska et al. 2004a) and to seeds of *L. angustifolius* (Sas-Piotrowska et al. 2004b). These results were partly confirmed in the present paper. The extract from bark of *A. hippocastanum* influenced positively germination viability and healthiness of oat seeds of Akt variety but in a case Bajka variety it caused increasing of seed infection.

Researches of Saniewska et al. (2001, 2003) indicate an inhibiting action of saponins extracted from *Medicago sativa* on growth of pathogens of ornamental plants. In our researches the extracts from *S. officinalis* which also contain saponins influenced positively healthiness of Akt variety but on the other hand reduced lon-

gevity and healthiness of seeds of Bajka variety. Extracts from this plant and also from *U. dioica* and *A. sativum* also influenced negatively longevity and healthiness of seeds of *Lupinus angustifolius* (Sas-Piotrowska et al. 2004b).

The comparison of the obtained results with those of other authors is difficult because there were mostly in vitro researches and were carried out on other plants and pathogens, while the present researches were conducted in vivo. The medicinal plants that were a source of the extracts originated from different deliverers, were grown in different environmental conditions and probably differed with a content of active substances. The mentioned factors might have determined a different impact on the examined material.

CONCLUSIONS

1. The longevity and healthiness of seeds treated with plant extracts depended on their origin, method of preparation and oat variety being tested.
2. The seed longevity of Akt variety was stimulated in both dates of evaluation by extracts from *M. officinalis* and *S. hortensis* and inhibited by extracts from *U. dioica* and *L. vera*. The seed longevity of Bajka variety was stimulated however by extracts from *T. officinale* and *M. chamomilla*, and inhibited by extracts from *M. officinalis* and *L. officinale*.
3. The seed infection of Akt variety was most strongly reduced in both dates of evaluation by infusions from *M. piperita* and *M. officinalis* as well as macerations from *M. piperita* and *L. officinale* while for Bajka variety those were infusions from *L. vera* and *C. sativum* as well as macerations from *S. hortensis* and *L. usitatissimum*. However the seed infection of Akt variety was stimulated by infusions from *A. vulgaris* and *C. oxyacantha* and macerations from *U. dioica* and *R. canina*, and of Bajka variety by infusions from *R. canina* and *M. chamomilla* as well as macerations from *U. dioica* and *A. vulgaris*.
4. Despite some differences between varieties and extracts, a favourable influence of the extract on seed healthiness manifested itself by their better longevity.

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POLISH SUMMARY

ŻYWOTNOŚĆ I ZDROWOTNOŚĆ NASION OWSA SIEWNEGO *AVENA SATIVA* L. TRAKTOWANYCH WYCIĄGAMI ROŚLINNYMI

Celem badań było poszukiwanie substancji biologicznie czynnych mogących ograniczyć stosowanie chemicznych środków ochrony roślin. W badaniach wykorzystano:

– Wyciągi wodne (maceraty, napary) przygotowane z różnych części morfologicznych 39 gatunków roślin: 1. *Acorus calamus* L. – kłącze; 2. *Aesculus hippocastanum* L. – kora; 3. *Aesculus hippocastanum* L. – kwiat; 4. *Allium sativum* L. – cebula; 5. *Archangelica officinalis* Hoffm. – korzeń; 6. *Arctium lappa* L. – korzeń; 7. *Artemisia absinthium* L. – ziele; 8. *Artemisia vulgaris* L. – ziele; 9. *Betula verrucosa* Ehrh. – liście; 10. *Calendula officinalis* L. – kwiat; 11. *Camelina sinensis* L. – liście; 12. *Carum carvi* L. – owoc; 13. *Coriandrum sativum* L. – owoc; 14. *Crataegus oxyacantha* L. – kwiat; 15. *Equisetum arvense* L. – ziele; 16. *Frangula alnus* Mill. – kora; 17. *Hyssopus officinalis* L. – ziele; 18. *Inula helenium* L. – korzeń; 19. *Juglans regia* L. – liście; 20. *Juniperus communis* L. – owoc; 21. *Lavandula vera* L. – kwiat; 22. *Levisticum officinal*e L. – korzeń; 23. *Linum usitatissimum* L. – nasiona; 24. *Marrubium vulgare* L. – ziele; 25. *Matricaria chamomilla* L. – koszyczek; 26. *Melissa officinalis* L. – liście; 27. *Mentha piperita* L. – liście; 28. *Origanum majorana* L. – ziele; 29. *Pinus sylvestris* L. – młode pędy; 30. *Quercus robur* L. – kora; 31. *Ribes nigrum* L. – liście; 32. *Rosa canina* L. – owoc; 33. *Salix alba* and *S. purpurea* L. – kora; 34. *Sambucus nigra* L. – kwiat; 35. *Saponaria officinalis* L. – korzeń; 36. *Satureja hortensis* L. – ziele; 37. *Taraxacum officinale* Web. – korzeń; 38. *Urtica dioica* L. – liście; 39. *Verbascum thapsiforme* L. – kwiat; 40. *Zea mays* L. – znamiona.

Kontrolę stanowiły nasiona owsa traktowane sterylną wodą destylowaną. Maceraty i napary przygotowywano według receptury podanej we wcześniejszym opracowaniu.

– Nieodkażone nasiona dwóch odmian owsa siewnego: nagoziarnistej Akt oraz oplewionej Bajka.

Doświadczenie przeprowadzono jako test bibułowy (PN-R-65950), określając w nim energię i zdolność kiełkowania nasion oraz ich zdrowotność.

Analiza wariancji wykazała istotnie zróżnicowane działanie wyciągów sporządzonych z różnych roślin oraz sposobów ich przygotowania na żywotność i zdrowotność nasion obu odmian. Udowodniono także istotność interakcji pomiędzy tymi czynnikami. Wykazano jednocześnie, iż każda z odmian reagowała odmiennie na ten sam zestaw wyciągów.

Niezależnie od sposobu przygotowania wyciągu kiełkowanie nasion odmiany Akt stymulowały wyciągi z liści melisy lekarskiej a kiełkowanie nasion odmiany Bajka – wyciągi: z korzenia omanu wielkiego i mniszka lekarskiego, koszyczków rumianku pospolitego i owoców róży dzikiej.

Porównując aktywność wyciągów w zależności od ich pochodzenia i sposobu przygotowania wykazano, że żywotność nasion odmiany Akt stymulowały napary z liści mięty pieprzowej i melisy lekarskiej oraz maceraty z kwiatu kasztanowca, liści melisy lekarskiej i mięty pieprzowej, podczas gdy w przypadku odmiany Bajka były to napary z korzenia omanu wielkiego i mniszka lekarskiego oraz maceraty z koszyczków rumianku pospolitego.

Podobne zróżnicowanie ujawniło się podczas analizy wpływu wyciągów roślinnych (niezależnie od sposobu przygotowania) na zdrowotność nasion obu odmian. Porażenie nasion odmiany Akt ograniczały wyciągi z liści mięty pierzowej i melisy lekarskiej, a odmiany Bajka – wyciągi z ziela cząbra ogrodowego, kwiatów lawendy prawdziwej, ziela lebiodki majeranku.

Aktywność wyciągów z badanych roślin była modyfikowana przez sposób ich przygotowania. Porażenie nasion odmiany Akt ograniczały napary z liści mięty pieprzowej, melisy lekarskiej, kwiatów nagietka lekarskiego oraz maceraty z liści mięty pieprzowej i korzenia lubczyku lekarskiego, podczas gdy porażenie nasion odmiany Bajka malało, gdy traktowano je naparami z kwiatu lawendy prawdziwej, owoców kolendry siewnej i maceratami z ziela cząbra ogrodowego, nasion lnu zwyczajnego i owoców kminku zwyczajnego.