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# Effects of foliar application herbicides to control semi-parasitic plant *Arceuthobium oxycedri*

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**Abstract.** *Kavosi MR, Faridi F, Hajizadeh G. 2012. Effects of foliar application herbicides to control semi-parasitic plant* Arceuthobium oxycedri. *Nusantara Bioscience 4: 76-80.* Epiphytes are plants growing on the stem and branches of other growing plants. Dwarf mistletoe (*Arceuthobium oxycedri*) is one of the important macro epiphytes or semi-parasitic plant, is able to damage *Junipers* and provide favorable conditions for bother damaging factors such as pest, disease, rodent animals and vulnerability to unfavorable climate conditions. In this study used herbicides in three concentrations (1.35, 1.93, 2.7 g of Roundup, 0.675, 0.964, 1.35 g of Basagran, and 0.9, 1.28, 1.8 g of Gramoxone in1000 mL water) and three replications to examine the impact of each herbicide on *A. oxycedri* at *Junipers* forests in areas located at the East Gorgan state region, North of Iran. The results from Basagran on 95.55% dwarf mistletoe indicated that the plant was dried completely up. Roundup dried 61.67% of dwarf mistletoe. Gramoxone causes the lowest percent of dryness (23.89%). By analyzing results about the impact of herbicides on percentage of measuring dryness, there is difference in level significant 1% between herbicides. The impact of each herbicide on *A. oxycedri* showed that concentration-3 has more impact on increasing dwarf mistletoe dryness but with concentration-2 it has less difference. Ultimately concentration-2 Basagran can be used to reduce costs in order to control dwarf mistletoe.

**Keywords:** herbicide, *Arceuthobium oxycedri*, epiphyte, dwarf mistletoe, semi-parasitic plant

**Abstrak.** *Kavosi MR, Faridi M, Hajizadeh G. 2012. Pengaruh aplikasi herbisida daun untuk memgendalikan tumbuhan semi parasit* Arceuthobium oxycedri. *Bioscience Nusantara 4: 76-80.* Epifit adalah tumbuhan yang hidup pada batang dan cabang tumbuhan lain. Benalu kerdil (*Arceuthobium oxycedri*) merupakan salah satu tumbuhan makro-epifit penting atau semi parasit, yang dapat merusak tanaman juniper dan mendorong hadirnya faktor perusak seperti hama, penyakit, hewan pengerat dan keretanan terhadap kondisi iklim yang tidak menguntungkan. Dalam penelitian ini, herbisida dibuat dalam tiga konsentrasi (1,35, 1,93, 2.7 g Round-up, 0,675, 0,964, 1.35 g Basagran, dan 0,9, 1,28, 1.8 g Gromoxone dalam 1000 mL air) dan tiga ulangan untuk mengetahui dampak masing-masing herbisida pada *A. oxycedri* di hutan juniper Gurgan Timur, Iran. Aplikasi Bazargaran pada benalu kerdil menghasilkan kematian sebesar 95,55% menunjukkan bahwa tumbuhan tersebut mengering seluruhnya. Round-up menyebabkan mengeringnya 61,67% dari benalu kerdil. Gromoxone menghasilkan persentasre pengeringan terendah (23,89%). Dengan menganalisis dampak herbisida terhadap persentase pengeringan, terdapat perbedaan pada taraf signifikansi 1% di antara herbisida. Dampak masing-masing herbisida pada *A. oxycedri* menunjukkan bahwa konsentrasi 3 lebih berdampak pada pengeringan benalu kerdil, namun hanya berbeda sedikit dengan konsentrasi 2. Pada akhirnya konsentrasi 2, Basagran dapat dipilih untuk mengurangi biaya dalam pengendalian benalu kerdil.

**Kata kunci:** herbisida, *Arceuthobium oxycedri*, epifit, benalu kerdil, semi-parasit tanaman.

## INTRODUCTION

Epiphytes are growing on branch and stems of other growing plants. Some of them are parasites; they are not abundant in Iran, because of climate conditions comparing with moderate areas and rainforests (Iranshahr 1999). Three genus and four species of these semi-parasitic plants have been reported at different areas of Iran, namely *Viscum album*, *Loranthus europaeus*, *Loranthus grewinkii*, and *Arceuthobium oxycedri* (Kavosi 2009). Dwarf mistletoes are parasite of different conifers as Pinaceae family including *Abies*, *Keteleeria*, *Larix*, *Picea*, *Pinus*, *Pseudotsuga*, *Tsuga* and Cupressaceae family including *Juniperus* (Hawksworth et al. 2002). Dwarf mistletoe (*Arceuthobium oxycedri*) is one of the important semi-parasitic plants, acts privately from the host and grows only on conifers (Kamp et al. 2003). This semi-parasitic plant is 20cm high and growing on branches of Junipers, at a glance it confused with moss. Its branches are smooth and articulate. Its leaves are scale-like, triangular and locate opposite on the branches. It is easy to differentiate male and female basis of this color in nature. Males are green-yellow and females are dark green. This plant's seeds are sticky and splitting the ripe fruit, throw and sit on the host tree's branch. This seed begins to grow in favorable condition and produce such organism, grows between bark and woods of the host tree's brand and make new base. This plant is a parasite of Juniper, spread in Spain, Northern African, Turkey, and North part of Iran (Mousavi and Shimy 1997).

*Arceuthobium oxycedri* in Iran is parasite of native conifers; it can damage trees in stage pole and small pole (Stewart and Ross 2007). This semi-parasitic plant reduces the crop, produce of seed and wood quality and makes some problems to this tree (attack of pest, fungi, and rodents) (Hawksworth et al. 2002). Finally, contamination from dwarf mistletoe will lead to produce compressed mass known as magic broom, which deforms branches. Intensive contamination lead tree to die completely (Hawksworth et al. 1996).

Herbicide selection is the first stage to control dwarf mistletoe. There are some challenges to find herbicide which easily available and are able to ruin dwarf mistletoe and not negative impact on host or other species (Hawksworth and Wiens 1996; Shamoun and Dewald 2002). Some killer herbicides have been tested to control mistletoes (Gill 1956; Quick 1964; Scharpf 1972; Dorji 2007). Most of chemical studies have used different formulas of herbicides such as 2,4,5-T and 2,4-D (amine salt). These herbicides not only kill mistletoes but also exert negative impact on the host and damage it. In low concentrations in which the host is secure parasite not be ruined and growing occurs (Shamoun and Dewald 2002). This research aimed at examines types and concentration of herbicides to kill *A. oxycedri* and protect the host from damaging. In this way, efficient management will achieve this semi-parasitic plant.

## MATERIALS AND METHODS

Regions involved in this study are Juniper Forest areas (*Juniperus polycarpus*) located at the East of Gorgan state region, North of Iran and 2200 m altitude. Conifer species in this area except *J. polycarpus* are *J. sabina* and *J. communis*. Dwarf mistletoe has not been observed on these two species. This showed that *A. oxycedri* appears only on the *J. polycarpus* and not on the broad-leaved tree.

In this study, three types of herbicides (Roundup, Basagran, and Gramoxone) were used to evaluate the effects of each on the *A. oxycedri*. Roundup is a systematic herbicide with SL 41% formula, after weeds sprout, it is used as spread on aired parts of them. Leaves and other aired organisms take this herbicide and Transferred to every part of weeds through vessels along with sap, cause weeds to death. This herbicide destroys chloroplast and gradually makes the weed yellow. The central shoot section is twisted but the plant isn't wounded because the central shoot is exalted. Plant will die 2-4 weeks later. This period depends on the content of herbicide and plant activity. Bentazone is commercially known as Basagran by SL 48% that is selective herbicide and efficient on weeds after growing. Third of herbicide is Paraquat commercially known as Gramoxone by SL 20%, Local–contact herbicide lead aired organisms to scorch. It is not able to transfer through underground organism. This herbicide is used as a boring against more than one–year–old weeds. Its consumption depends on the weeds mass and varies between 2 and 4 liters in a hectare. Gramoxone destroys cellular wall and exit cellular juice, plant seems dew (Mousavi 2007). After characterizing scattered organisms of Junipers contaminated by semi-parasitic plants (*A. oxycedri*) in Gorgan, spring (2009) some contaminated basis was chosen. In this study used herbicides in three concentrations (1.35, 1.93, 2.7 g of Roundup, 0.675, 0.964, 1.35 g of Basagran, and 0.9, 1.28, 1.8 g Gramoxone in 1000 mL water) and three replications (Table 1). Semi-parasitic plants were controlled chemically using two methods pre-sprouting and post-sprouting (Rashed-Mohassel and Mousavi 2006). We consider post–sprouting method. Herbicides were exerted to contaminate dwarf mistletoe, and two or three weeks later their impacts appeared. This was an impact in clued color, changing leaf falling and Juniper stems and drying rate. In addition to these impacts, by their impacts on host trees, they were recorded to all treatments.

**Table 1.** Concentrations used of Roundup, Basagran, and Gramoxone to control *Arceuthobium oxycedri* in study location.

| Herbicides | Concentrations × 1000 mL | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Roundup | 1.35 | 1.93 | 2.7 |
| Basagran | 0.675 | 0.964 | 1.35 |
| Gramoxone | 0.9 | 1.28 | 1.8 |

## RESULTS AND DISCUSSION

The drying percentage of *A. oxycedri* using three types of herbicides with three different concentrations were obtained by analyzing as seen in Table 2. Results suggest that Basagran in every concentration 1, 2 and 3 bring about high dying percent but Roundup in concentration-3 has maximum effect (76.67%), and Gramoxone in concentration-2 has the maximum dryness (30%). Basagran dried 95.55% of dwarf mistletoe, which among this herbicide has the maximum impact on this semi-parasitic plant. Also, Gramoxone causes the lowest percent of dryness (23.89%) (Figure 1 and 2).

**Table 2.** Drying percentage mean of dwarf mistletoe by using three type's herbicides and three different concentrations.

| Herbicides | Concentration | Mean | SD | N |
|---|---|---|---|---|
| Roundup | 1 | 51.67 | 18.9297 | 3 |
| | 2 | 56.67 | 12.5831 | 3 |
| | 3 | 76.67 | 5.7735 | 3 |
| | Total | 61.67 | 16.3936 | 9 |
| Basagran | 1 | 93.33 | 5.7735 | 3 |
| | 2 | 95.00 | 5.0000 | 3 |
| | 3 | 98.33 | 2.8867 | 3 |
| | Total | 95.55 | 4.6398 | 9 |
| Gramoxone | 1 | 15.00 | 8.6602 | 3 |
| | 2 | 30.00 | 5.0000 | 3 |
| | 3 | 26.67 | 5.7735 | 3 |
| | Total | 23.89 | 8.9365 | 9 |
| Total | 1 | 53.33 | 35.6195 | 9 |
| | 2 | 60.55 | 29.2024 | 9 |
| | 3 | 67.22 | 32.1239 | 9 |
| | Total | 60.37 | 31.6813 | 27 |

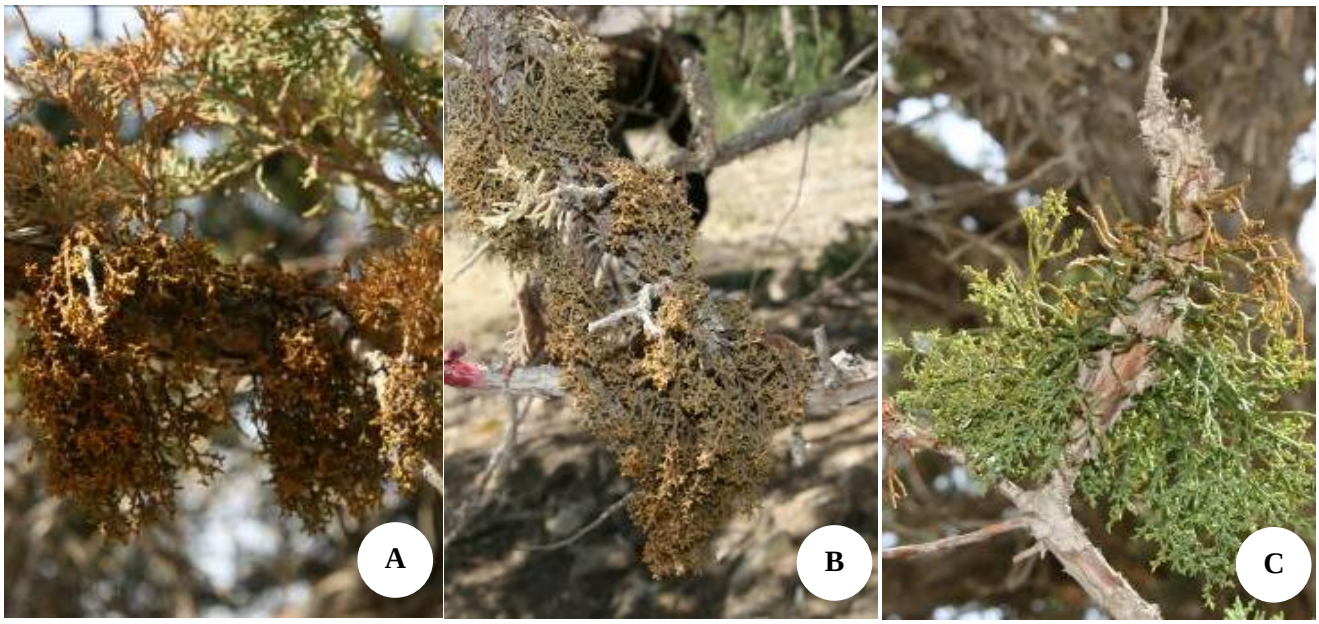


**Figure 1.** Efficacy of several herbicides on dwarf mistletoe. A. Basagran, B. Round-up, C. Gromoxone

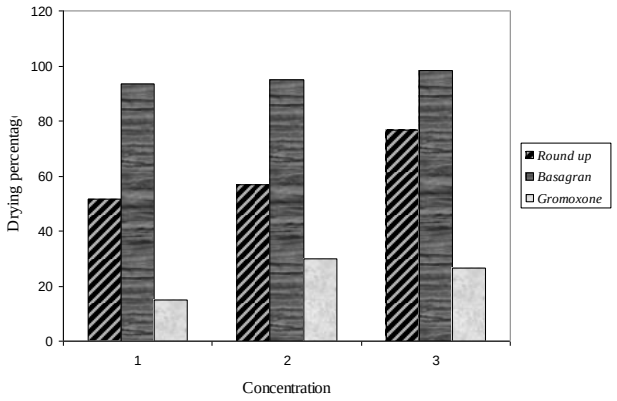


**Figure 2.** Efficacy of herbicides with three different concentrations on dwarf mistletoe

According to Figure 2, it can be seen that Basagran in all concentrates dry *A. oxycedri* in high percentage. The interesting point about this herbicide is that it dries the dwarf mistletoe to almost 50 cm near the poisoning dwarf mistletoe. Variance analysis from Table 3 showed that impacts of type herbicides and their concentration, there is considerable difference among all kind of herbicides at level significant 1% and every concentration at level significant 5%.

The experiment showed that Basagran has the maximum impact and is significant difference at level significant 1% with other herbicides (Figure 3). Based on results from this study, it has priority to others in fighting chemically against dwarf mistletoe. As it dry 100% of this semi-parasitic plant and also it dwarf mistletoe near poisoning branches, this guarantee that sprouting doesn't occur again because of the herbicide influence in entophytic system and prevent *A. oxycedri* to sprout on the host a year after controlling. The impact of three concentration on drying rate showed that concentration-3 has more impact increasing dwarf mistletoe dryness and it has significant difference with concentration-1 at level significant 5%, but concentration-2 has not significant difference with concentration-1 and 3 (Figure 3).

**Table 3.** Results of variance analysis in dry *Arceuthobium oxycedri* that was treatment by using herbicides in different concentrations.

| Source | df | SS | MS | F | Sig. |
|---|---|---|---|---|---|
| Herbicide | 2 | 23135.185 | 11567.593 | 138.811 | 0.000** |
| Concentration | 2 | 868.519 | 434.259 | 5.211 | 0.016* |
| Herbicide × concentration | 4 | 592.593 | 148.148 | 1.778 | 0.177 ns |
| Error | 18 | 1500.000 | 83.333 | | |
| Total | 26 | 26096.296 | | | |

Note: Asterisks (*P < 0.05, **P < 0.01) indicate significant differences between the treatments. Asterisks (nsP > 0.05) indicate not significant differences between the treatments.

Since the twentieth century, chemical control of semi-parasitic plants has been an innovation. This method is beneficial to reduce these plants development by chosen herbicides (Fathi and Arjmand 1999). Developing chemistry applications in the second half of 19 century and some chemicals entered the selected control phenomenon into the fight against parasite weeds (Rashed-Mohassel and Mousavi 2006). Using herbicides especially in developed countries has been successful, and it was examined that this element could solve the problems semi-parasitic plants and weeds (Finney 1988).

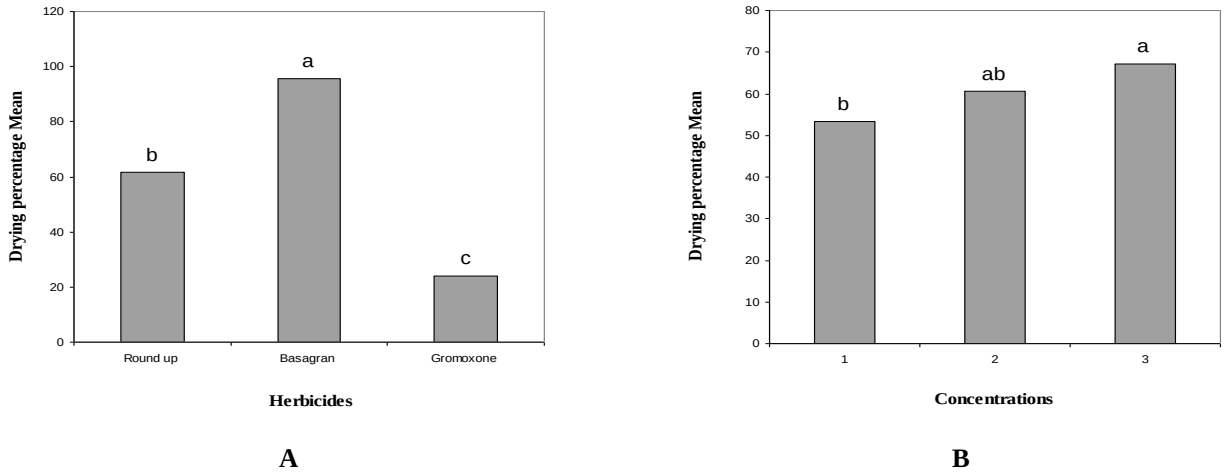


**Figure 3.** Comparison of types (A) and concentration (B) of herbicides to kill *Arceuthobium oxycedri* and protect the host from damaging.

In this study, chemical toxins were used to control *A. oxycedri* in order to identify the best toxin results from experiment showed that Basagran prevents dwarf mistletoe to spread because it has no negative impact on Juniper trees as its appearance remain fresh and green but it dried dwarf mistletoe completely and poisoning in seepage entophytic system of plant, prevent it from growing. This is important, because in previous studies; most of herbicides caused the host to dry (Gill 1956; Scharpf 1972; Dorji 2007). But this was not true about Basagran. Similar studies were carried out in which toxins have not negative impact though they dried some semi-parasitic plants, but they couldn't prevent *A. oxycedri* to sprout on the host a year after controlling (Quick 1964; Hawksworth and Wiens 1996). The results showed that concentration-3 has more impact on Juniper dryness and it differs from concentration-1 in level significant 5% but concentration-2 has less difference with concentrations-1 and 3 because of this it can be concluded that it is better to use concentration-2 in Basagran to reduce cost. In such situation, lower values are sufficient to reach successful controlling (Griffin et al. 1992; Sullivan and Bouw 1993; Defelice and Kendig 1994). In this study, every herbicide brought about different reacts in lost and semi-parasitic plant. Roundup in various concentrations changed the dwarf mistletoe color (light brown to yellow) after two weeks and *A. oxycedri* separated in stew bands and begun to fall gradually. This herbicide is used to prevent this plant fertility and production because without affecting lost tree it only causes the leaves and stews if *A. oxycedri* to fall. Basagran in most concentrations and treatments lead dwarf mistletoe to dry not falling from trees and its color became dark brown. Other impacts of this herbicide dry growing and productive of host (without affecting wood structure) to distance 30-50cm from dwarf mistletoe locution to the end of branch and after this distance branch will be fresh and green but Gramoxone in most con concentration has less impact with little changed color (yellow-green) on productive and growing *A. oxycedri* and on the host because it delays the plant growth by destroying cellular wall and exiling cellular juice bored the semi-parasitic plant.

*Juniperus polycarpus* resistance to hand climate conditions and heavy falling snow in standing regions is because of their symmetric and mass crown. *A. oxycedri* changes the crown to broomy form and changes their symmetric form and severe trees dryness in contaminated regions by wind snow and cold weather (Hawksworth et al. 1996). Using herbicides, not only they kill dwarf mistletoe, but also return the crown to its normal form and made the plant resistant to hard climate conditions.

One interesting point in this study was that, because *A. oxycedri* is fresh all the times, it is easier to fight with this semi-parasitic plant. Trees make *A. oxycedri* poisoning with lowest pollution in environment. To use herbicides, mechanical or combustion machines are applied, but it is better to use mechanical to reduce cost, because junipers are spread in mountainous areas. Using herbicide instead of mechanic deletion to control weeds help to prevent soil erosion by returning material back to it (Rashed-Mohassel and Mousavi 2006). Effective management and analysis on *A. oxycedri* would control this semi-parasitic plant in coming years and herbicides consumption will be less than now and costs will be minimal (Burnside et al. 1986).

## CONCLUSION

The effectiveness of three herbicides at various dosages was determined, in study carried out in Gorgan state region, North of Iran during 2009 for the control of dwarf mistletoe, *A. oxycedri*, an aerial parasite of *Juniperus oxycedri*. Results improved with Basagran dried of dwarf mistletoe, which among this herbicide has the maximum impact on this semi-parasitic plant and Gramoxone cause the lowest percent of dryness.

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