ECOLOGY, BIOTECHNOLOGY, AGRICULTURE AND FORESTRY

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PROBLEMS AND SOLUTIONS

EDITED BY
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The monograph is a collection of the results of scientists' achievements obtained directly in real conditions. The authors are recognized specialists in their fields, as well as young scientists and graduate students of Ukraine. The studies are conceptually grouped in sections: biotechnology, ecology, agriculture, forestry, sustainable development of the economy and the principles of effective agribusiness. The monograph will be of interest to specialists in biotechnology, ecology, breeding, plant protection, agrochemistry, soil science, forestry, agribusiness, etc., researchers, teachers, graduate students and students of specialized specialties of higher educational institutions, as well as everyone who is interested in sustainable development in the agricultural sphere and Green Deal Implementation strategies.

Keywords: sustainable development, modern technologies, agricultural production, biotechnology, ecology, plant protection, forestry, agribusiness.

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THE INFLUENCE OF EUROPEAN DEER (CERVUS ELAPHUS) ON THE UNDERGROWTH IN THE FORESTS OF THE FOREST-STEPPE PART OF KHARKIV REGION

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The peculiarities of deer behaviour during the winter period on the hunting farms of the Forest-Steppe part of Kharkiv region are considered. The regularities regarding the formation of deer stay places in different types of hunting lands have been determined. Deer stay places differ by area, occupying mainly the areas of the last two years places for stay in medieval forest tree stands, which are formed on the plain (watershed and catchment) with a dense undergrowth of woody species.

The biological diversity of tree species damaged during deer winter feeding has been studied. The most damaged tree species, depending on the type of a forest, are Úlmus laévis Pall and Acer campéstre L. Various tree species are damaged by deer differently in the same type of a forest. The level of tree damage and the type of damage depends primarily not on the type of a forest, but on the type of tree species.

Key words: deer, place for stay, fodder ration, winter nutrition, types of damage

Problem formulation.

Hunting fauna of Ukraine is represented by a variety of animals' species, among which the European deer (Cervus elaphus) occupies one of the leading places.

The deer itself has become a species, on which the trophy hunting has begun in the world. The descriptions of deer hunting date back to the Hellenic periods, and the first trophies that have been preserved up to our times are dated by 1119 year. They are kept in the castle of Foix, one of the residences of the Navarrese kings, which have become the kings of France.

Nowadays, deer is being hunted both collectively and individually in Ukraine. It is significant that the limit of using deer (European and spotted ones) shooting, trapping in the Ukrainian hunting farms for the remaining five years has significantly increased - by 22%. In 2016-2017 years it was 972 heads, and in 2020-2021 pp. − 1248 heads [10, 11].

The minimum cost is of only trophies (antlers) of deer in the hunting farms of Ukraine, without taking into account the farm's services equals to about 20 thousand hryvnas. The trophy cost depends upon the quality of antlers. The number of outgrowths, the symmetry of the crown, the mass, the availability of the beaten parts of the antlers etc are taken into consideration. Trophy hunting of European deer allows to increase significantly the profitability of the hunting farm.

To form within a separate hunting farm deer population where the males with high quality of trophy antlers will be presented only under the conditions of creating optimum conditions of keeping animals on the hunting farm that is impossible without a detailed investigation of all aspects of its viability especially in winter when animals suffer from unfavourable nature factors.

On the plains, the deer live settled, on comparatively small plots (300–400 ha in summer and 200 ha in winter) [1, 2, 5]. It is known that within one year, the size of the herd of the European deer differs by a great impulsiveness and increases up to December, and then it rests virtually unchangeable until the end of winter [3].

In winter, the fodder diet decreases significantly; in many cases, deer switch to branch food. On the whole, deer eat no less than 300 species of plants, mostly grass, leaves, sprouts, fungi and lichens. They may eat such poisonous plants as belladonna and aconite [1]. There is a false thought that in winter the deer can eat only coniferous plants, but in such case they often die from the inflammation of the gastrointestinal tract.

The aim of the research was to carry out the analysis of the peculiarities of forming places for European deer stay during the winter period in various edatops and hunting lands, as well as the influence of this species population on the undergrowth of tree and bush species in hunting farms of Kharkiv region.

Objects and methods of the research.

The investigation was carried out on the hunting lands of CLR "Safari XXI", PE HF "Gremiachiy Kliuch", CLR "Sviatobor", which are located in the forest-steppe part of Kharkiv region on the territory of Vovchansky, Pechenizhsky and Chuguivsky districts. During 2016–2021 years 50 places for stay of deer (PS) were observed. They were created in the area of location of the feeding yards, agricultural lands with winter cereals, as well as homesteads and orchards. For the place of deer stay, the areas with the presence of traces of repeated deer staying, i.e. the fan type of approaches, [8], a significant amount of damaged undergrowth and understory, beds, excrements were accepted. To the group of damaged trees belong trees which had gnawed bark in the form of stripes. Such damages could be done only by deer in the farms under study. The observations were carried out over 5 herds of deer. The herds comprised up to 10-15 heads and were similar by age and *sex.*

The animals were counted on stay places from 5.00 till 7.00 and from 17.00 till 22.00 o'clock, with the help of a thermal imager Yukon Pulsar Quantum HD5OS.

The forest-taxation indications of damaged trees, undergrowh and understory were defined according to the generally accepted methods in the spring-summer period [6,9]. The height and size of injured places on the trees were measured with a measuring ruler. Efforts necessary for the bark removal, were defined with the help of electronic devices.

For the clarification of the regularities of forming and locating the places for stay on hunting farms two ecological profiles were laid. They crossed mostly the hunting lands from west to south, occupied the main geo-morphological parts of the relief and various types of hunting lands.

While laying the profiles, the actual placement of feeding yards in the hunting farms, agricultural lands with winter cereals and other natural fodder stations was considered. For clarification of the edatop and the type of forest the grass cover in the period when most plants entered the generative phase of development was described.[4].

Discussion of the results.

The studied hunting farms are characterized by lands of II-III- d

quality bonitet class for European deer. The structure of the lands within the farms is characterized by dominance of forest lands, represented mainly by oak tree stands of various ages.

Deer herds within the researched hunting farms formed a different quantity of places for stay. Depending upon the herd, the number of PS was 8–13 items. Particularly, herds No. 1−2, which were in Safari XXI CLR, formed 11−13 places for stay. Herds No. 3−5, which were located on the territory of PE HF"Gremyachi kliuch" and CLR "Sviatobor"- 8−9 places. Deer spent more time on the same places for stay, on hunting lands, where the disquietedness factor is low. Forestry crews and hunting teams (during the hunting season) were the main factor of animals' concern during winter period. During 24 hours, each herd moved between different places for stay. The intensity of movement decreased during unfavourable weather (snowfall and low temperatures). In the evening, all the herds, which were monitored, went to the places for stay near the feeding yards, fields of winter cereals and orchards etc.

The area of each of the European deer places for stay ranged from 0.4 to 0.7 ha (table 1.). The size of the place depends on the number of individuals in the herd, term of stay on it, the thickness of the snow cover (as a factor affecting the easy availability of grassy vegetation, that is Carex pilosa,), the availability of fodder in the feeding yard, etc.

Table 1. Damaged undergrowth on the deer stay site

It has been determined that mass feeding of deer by branch fodder occurs when the depth of the snow cover reaches more than 15 cm. When the depth of the snow cover is up to 15 cm, deer eat willingly Carex pilosa, which is well preserved under the snow.

In the process of the conducted research, it has been found that the deer did not actually damage the plants while moving along the trail to the places of feeding or staying. Only minor damage of undergrowth along the trail has been recorded. On the average, animals damaged two to five trees on every 100 m. At the same time, the damage was partial and in future they did not lead to drying of trees. It should be noted that the number of damaged trees increased when approaching the places for stay or feeding yard. Before entering the feeding yard or other feeding station, deer spent much time near them at the distance of up to 800 m.

Deer did not form places for stay in young trees stands or forest crops, preferring medieval stands formed on the plain (watershed and catchment) part with the presence of dense undergrowth of woody species. Deer form the largest in terms of PS area in places of relief decreasing. The results of the forest typological survey of lands covered with forest vegetation, of the investigated hunting farms in the places of the deer stays, show that they are formed mainly in fresh and humid hydro-tops (37 and 13 PS, respectively), within which fresh and moist maple-linden forest is presented. It should be noted that in terms of forest typology, within the studied hunting farms, the share of fresh maple-linden forest is about 97-99% of the area of lands covered by forest vegetation of the corresponding forestry enterprises [7].

Deer, as a rule, spend a long time on stay places during the winter period. Deer can make stay places on the same place for several years. It has been recorded that out of 50 observed places for stay, 37 were formed on sites of the previous two years . Because of the constant damage (actually yearly) of the same trees, their state and productivity are significantly reduced.

While comparing the stay places located in fresh and wet maple-linden forests, some differences were defined. First of all, stay places are characterized by larger areas in wet maple-linden forests. The size of the stay places in wet maple-linden forests varied within 0.4-0.7 ha, and in the fresh one - within 0.4-0.5 ha. In various forest types, deer actually damaged the same species, but their ratio was different. The number of trees damaged on PS in wet maple-linden forests is greater than the similar index of PS in fresh maple-linden forests. In the terms of 1.0 per ha, the amount of damaged undergrowth on places for stay in wet maple-linden forests varied

between 980-1115 items, or 50-53%; in fresh maple-linden forests - 790-843 items or 39-42% of the total amount of available undergrowth. It has been determined that in fresh and moist maple-linden forests, deer feed mainly on Úlmus laévis Pall., Ácer campéstre L. and Fráxinus excélsior L. without damaging actually other tree species.

The results of damaged trees accounting on places for stay in wet maple-linden forests show that of the total amount of all damaged trees, the share of Úlmus laévis Pall. is 89% (76% of the total number of elms on the area), Ácer campéstre L. 10% (15 % of the total amount of maple on the area), Fráxinus excélsior L. about 1% (14% of the total amount of ash on the area). There were also single damaged specimens of Quercus róbur L. and Tília cordáta Mill. It should be noted that the bark of Úlmus laévis Pall. and Ácer campéstre L. was gnawed, and the buds and tops of the undergrowth were gnawed on the Fráxinus excélsior L. Mass gnawing of the tops of Euonymus europaeus L. and Euonymus Verrucosa Scoop. was also recorded, but we could not determine reliably the amount of damage caused by deer to rowan. During the observations over deer, it was found that not only they, but also European roe deer gnawed rowan.

It has been determined that in fresh maple-linden forest on places for stay, 77% of the total mass of all damaged trees (39–42% of the total amount of undergrowth on the area) is Acer campéstre L (72% of the total amount of maple on the area), 13% is Fráxinus excélsior L. (15% of the total amount of ash on the area), 10% - Úlmus laévis Pall. (up to 84% of the total amount of elm on the area).

Damaged specimens of elm and maple undergrowth are mainly represented by the 2d age class (11-20 years). At the same time, the average diameter of the damaged undergrowth was 5.10 cm (±0.45), and the undamaged one was 5.65 cm (±0.35). The minimum diameter of the damaged specimens of undergrowth reached 3.0 cm, the maximum - 8.4 cm.

The average height of the damaged undergrowth was 6.45 m (± 0.49), and the undamaged one was 7.1 m (± 0.38). The minimum height of the damaged undergrowth was 2.85 m, the maximum - 9.3 m.

The damages height ranged from the ground up to 2.9 m. At the same time, the height of the damage from the bottom was determined by the height of the snow cover. The maximum height of damage in various tree species is different. For example, for Úlmus laévis Pall it ranged from the ground up to 2.9 m, for Acer campéstre L - from 0.35 to 2.3 and for Fráxinus excélsior L. - within 0.5–1.8 m.

It has been defined that elm bark is removed with long stripes up to 90−120 cm long (table 2), Acer campéstre L – 30−45 cm, Fráxinus excélsior L. – up to 10 cm. The effort required to remove bast for elm is - 0.35-0.40 kg/cm2, maple and ash - 0.60-0.70 kg/cm².

Table 2. Damage of Úlmus laévis Pall, in the form of removed long stripes of bast.

Five options for tree damage have been identified in the research:

– very severe damage (bark removal along the diameter of the tree occurred in 75-100% without remnants of bark elements on the damage area, the length of the damage is more than 2.0 m, or more than 1/2 of the tree's height);

– severe damage (bark removal along the diameter of the tree occurred in 50-74% without remnants of bark elements on the damage area, the length of the damage is 1.1-2.0 m, or 1/3-1/2 of the tree's height);

– medium damage (bark removal along the tree diameter occurred in 25-49% with possible significant remnants of bark elements on the damaged area, the length of the damage is up to 1.0 meters or less than 1/3 of the tree's height);

– weak damage (the bark removal by the diameter of the tree occurred in 5–25% with possible significant remnants of bark elements on the damage area, the length of the damage is up to 1.0 m, or less than 1/3 of the tree's height);

1) 

2) 

3) 

4) 

5) 

Table 3. Variants of tree damage: a) very severe damage; b) severe damage; c) medium damage; d) weak damage; e) very weak damage

– very weak damage (the bark removal along the diameter of the tree was not actually recorded, there are isolated traces of damage, the length of the damage is up to 0.5 m).

Very severe damage of trees leads to their complete drying. As a result of severe damage, 40% of the trees dry, 60% of them have dry sides. Trees having medium and weak types of damage are mostly dry. Trees with the signs of weak damage, have local bark necrosis in the places where bark was stripped. At the same time, trees with very little damage fully restore within the next two years. It should be noted that Úlmus laévis Pall (60%) and Acer campéstre L (35%) damaged during the last two years are characterized by the presence of signs of Verticillium wilt. This infectious disease of deciduous trees is caused by fungi of the genus Verticillium. Complete dying of the elm undergrowth occurs within one growing season in the sharp form, and in the chronic form - during several years [12].

Trees with a strong, medium and weak type of damage have the decrease both in height and diameter. At the same time, the greater the damage is the greater the difference in annual growth.

Various tree species in the same type of a forest are damaged by deer differently. The level of trees damage depends primarily not on the type of a forest, but on the type of tree species. Particularly, Úlmus laévis Pall is characterized by a very strong and severe level of damage (30 and 40 % of all damaged elm trees), Acer campéstre L has medium level(55 % of all damaged maple trees), Fráxinus excélsior L. is characterized by weak level (90 % of all damaged ash trees).

Conclusion. Deer places for stay differ by area (0.4−0.7 ha), occupying mainly the areas of the last two years places for stay, located mosty in medieval tree stands, which are formed on the plain (watershed and catchment) with a dense undergrowth of woody species.

Úlmus laévis Pall and Acer campéstre L prevail in the winter ration of branch fodder of European deer. In the conditions of fresh maple-linden forest a share of damaged undergrowth ranges from 39–42% of the total amount of undergrowth on the area, in wet maple-linden forest it comprises 50–53%. Depending on the type of a forest, the share of damaged undergrowth of Úlmus laévis Pall ranges within 76–82% (of the total number of elms on the area), Acer campéstre L. (15–77% of the total number of maples on the area).

Because of severe damage, 40% of trees dry, and 60% have dry sides. Mostly dry sides were recorded in trees with medium and weak types of

damage. At the same time, the damaged specimens of the undergrowth fall behind the control undamaged specimens in diameter and height.

References

1. Amosov V.A. et al. (1973). Ohotniche hozyajstvo SSSR. Moskwa: «Lesnaya promyshlennost», 405 (in Russian).
2. Bannikov A.G., Uspenskij S.M. (1973). Ohotnichi promyslovye zveri i pticy SSSR. Moskwa: «Lesnaya promyshlennost», 167 (in Russian).
3. Voloh A.M. (2014). Ohotnichi zveri Stepnoj Ukrainy: Monografiya. Herson: FLP Grin D.S., 412 (in Russian).
4. Vorobev D.V. Metodika lesotipologicheskih issledovanij. Kiew: Urozhaj, 1967, 388 (in Russian).
5. Gerasimov Yu.A. (1988). Spravochnik egerya. Moskwa: Agropromizdat, 271 (in Russian).
6. Girs O. A., Novak B.I., Kashpor S.M. (2004). Lisovporyadkuvannya. Kiyiv: Aristej, 384 (in Ukrainian).
7. Goroshko V .V. et al. (2009). Tipologichna struktura vodozboru richki Velika Babka. Visnik HNAU im. V.V. Dokuchayeva, № 3, 171–174 (in Ukrainian).
8. Goroshko V.V. (2017). Formuvannya trop mislivskoyu faunoyu bilya pidgodivelnih majdanchikiv mislivskih gospodarstv Livoberezhnogo Lisostepu Ukrayini. Naukovij visnik NLTU Ukrayini. Vip. 1, 25–28 (in Ukrainian).
9. Dospehov B.A. (1965). Metodika polevogo opyta. Moskwa: Kolos, 423 (in Russian).
10. Pro vstanovlennya norm vidstrilu inshih mislivskih tvarin, vidnesenih do derzhavnogo mislivskogo fondu, u sezon polyuvannya 2016/2017 rokiv: Nakaz Ministerstva agrarnoyi politiki ta prodovolstva Ukrayini vid 05.04.2016 № 144 zareyestrovano v Ministerstvi yusticiyi Ukrayini 19 kvitnya 2016 r. za № 601/28731
11. Pro zatverdzhennya Limitiv vikoristannya (vidstrilu, vidlovu) dikih parnokopitnih ta hutrovih zviriv i vstanovlennya Norm vidstrilu inshih mislivskih tvarin, vidnesenih do derzhavnogo mislivskogo fondu, u sezon polyuvannya 2020-2021 rokiv: Nakaz Ministerstva energetiki ta zahistu dovkillya Ukrayini vid 25.05.2020 № 339 Zareyestrovano v Ministerstvi yusticiyi Ukrayini 01 chervnya 2020 r. za № 487/34770
12. Verticilleznoe usyhanie (vilt) klena URL: https://lesvstep.com/bolezni-i-vrediteli/vilt-klena