Effect of trampling on fructification of *Cantharellus cibarius* Fr.: Fr. and *Boletus edulis* Bull.: Fr. in Scots pine forests

J. Kasparavičius

Institute of Botany,
Žaliųjų ežerų 47,
LT-2021 Vilnius, Lithuania

The effect of trampling on the fructification of two species of edible mushrooms most popular in Lithuania was investigated. The results show that trampling during the main period of fructification decreased the biomass of a separate fruit body of *C. cibarius* in the subsequent years. However, in the two years following the experiment the yield (general biomass and fruit body number) of *C. cibarius* in the experimental plots was higher than in control plots. It was ascertained that the mean number of *C. cibarius* fruitbodies in experimental plots depended more on the precipitation sum during the main fructification period. Due to an insufficient amount of *B. edulis* fruitbodies the obtained results were not statistically reliable.

Key words: *Cantharellus cibarius*, *Boletus edulis*, trampling, fructification, biomass

INTRODUCTION

The increased commercial mushroom harvests in Lithuania during the last ten years have created a number of questions on the biology of the most popular mushroom species *Cantharellus cibarius* Fr.: Fr. and *Boletus edulis* Bull.: Fr. such as the influence of heavy harvesting and the secondary effect of trampling on the fruiting.

To answer these questions, a study on the impact of trampling on the fruiting of *C. cibarius* and *B. edulis* in Scots pine forests was carried out.

Similar long-term studies in which the effect of trampling was investigated were carried out in Russia [1–4] and Switzerland [5]. In these studies the effects of various factors on subsequent fruiting of larger mushrooms was investigated. Due to the different purposes of these investigations and differences in the climatic conditions, soil type and vegetation cover the obtained results were not always comparable with the results of the present work.

MATERIALS AND METHODS

Three 30×15 m investigation plots were selected in south-western Lithuania in 1997. The forest in the plots was of *Cladonio pinetum sylvestris* association. In the same year a primary investigation of the fruiting of the above-mentioned mushroom species was carried out. Mapping of the fruit bodies showed that patches of the study mushroom species were located in all plots very unevenly.

Partly modified methods of studying the effect of trampling on the subsequent fruiting of mushrooms worked out by other mycologists [3, 4] were employed.

The long term meteorological data were obtained from regional weather stations.

RESULTS

During the fructification period of 1998 when the trampling experiment took place, mushroom yield in the experimental plots was twice as high as in the control plots. In 1999 in the control plots the number of fruit bodies of *C. cibarius* was slightly less than in the experimental ones, but the total weight of fruit bodies from the control plots was almost twice as high as in the experimental ones (see Table). The harvest of 1999 was the lowest during the whole period of investigation both in the experimental and control plots. This fact shows that the yield was related to the meteorological conditions, as in 1999 the sum of precipitation during the vegetation period was lower than the mean sum of many years. In 2000, in experimental plots the yield of *C. cibarius* fruit bodies was six times higher than in the control plots, but their total weight was only three times (Table). As the mean fruit body quantity in experimental plots was higher than in control

throughout the whole investigation, the mean biomass of one fruit body in experimental plots was more than twice as low as in control plots (1998 being an exception) (Fig. 1). In 1998 the mean fruit body biomass in experimental plots was almost equal to the mean biomass of one fruit body of control plots (Fig. 1).

The mean quantity of fruit bodies of *C. cibarius* in experimental and control plots per year was compared with the sum of average monthly temperatures and the sum in the precipitation of vegetation period. The results showed that during the time of investigation the mean quantity of fruit bodies of *C. cibarius* in experimental plots every year reliably correlated with precipitation during the main fructification period (July–September) ($R^2 = 0.89$, $n = 3$, $p < 0.05$). A correlation of the mean quantity of fruit bodies of *C. cibarius* in control plots with precipitation during the main fructification period was weaker ($R^2 = 0.74$, $n = 3$, $p < 0.05$). There was no statistically reliable correlation between the mean quantity of fruit bodies in experimental ($R^2 = 0.43$, $n = 3$, $p < 0.05$) and control plots ($R^2 = 0.25$, $n = 3$, $p < 0.05$) and the average monthly temperature of the vegetation period.

Boletus edulis yielded very scantily during the time of investigation. In 1998 the harvest of *B. edulis* was the least (Table), in 1999 it was slightly bigger and in 2000 the biggest. It is possible, that in 1998 the harvest was so small due to the trampling experiment, because the decrease in the productivity of *B. edulis* might be related not only to the mechanical influence on the fruit bodies and mycelium, but also to a negative influence of soil enrichment with nutritive elements [4] from decaying damaged mycelium, moss cover and roots of trees. This presumption is based on the fact that fertilization has a negative influence on the fruiting of *Boletus edulis* [6]. In any case, due to the insufficient number of *B. edulis* fruit bodies the obtained results on the influence of trampling on the fruiting of *Boletus edulis* are not statistically reliable.

DISCUSSION

The relatively abundant harvest of *C. cibarius* in the experimental plots in the years when the trampling experiment took place could related to the meteorological conditions favourable for fruiting: the sum of

Table. **Harvesting of *Cantharellus cibarius* and *Boletus edulis* during the period of investigation**

Items	Year					
	1998		1999		2000	
	experiment	control	experiment	control	experiment	control
1. Total quantity of fruit bodies of *C. cibarius*	853	369	114	100	494	75
2. Mean quantity of fruit bodies of *C. cibarius*	284.3 ± 130.4	123 ± 145.2	38 ± 48	33.3 ± 46.2	164.7 ± 150.9	25 ± 24.5
3. Total biomass of fruit bodies of *C. cibarius,* g	3170.7	1341.1	132	258	925.1	332.8
4. Total quantity of fruit bodies of *B. edulis,* g	2	2	4	2	8	7
5. Total biomass of fruit bodies *B. edulis,* g	105.5	99.4	13.3	155	438.7	564.6

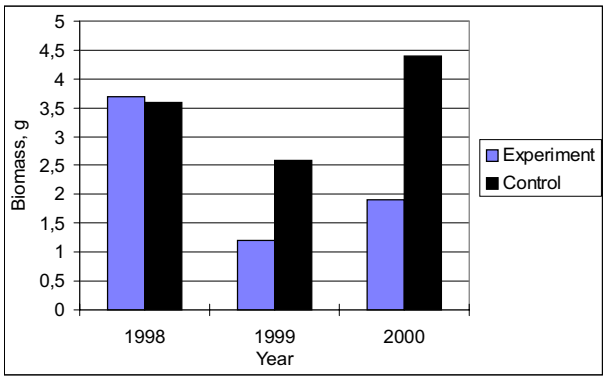

Fig. 1. Comparison of mean *Cantharellus cibarius* fruit body biomass in experimental and control plots during the period of investigation

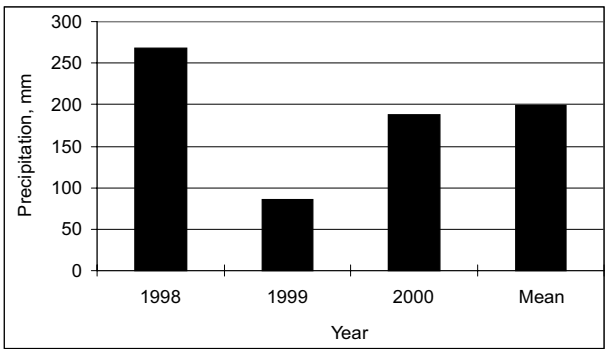

Fig. 2. Comparison of precipitation quantity during the main fructification period (July–September) in the period of investigation and the mean precipitation of this period

precipitation in the vegetation period was bigger than the mean longterm sum of precipitation in this region (Fig. 2). The majority of fruit bodies (77.3% of annual quantity) in the experimental plots was sampled before the intensity of trampling achieved 100 passages on m^2. Also, it is known that chanterelle can fructificate even in forest sites damaged by recreative human activity, on the paths were the vegetation cover and litter are completely destroyed [1].

The higher dependence of the mean quantity of of *C. cibarius* fruit bodies in the experimental plots on precipitation and an evident decrease of the mean biomass of one fruit body may be explained by the fact that litter became thinned out by trampling and therefore the absolute soil wetness decreased and the soil humidity fluctuation amplitude increased [2]. This has happened because the moss cover was damaged by trampling and the growth conditions were worse in experimental plots than in control, and it is known that the moss cover ensures stable humidity of the upper soil layer and litter [2, 7], which is very important to the growth and development of fruit bodies of *C. cibarius*.

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J. Kasparavičius

TRYPIMO POVEIKIS *CANTHARELLUS CIBARIUS* FR.: FR. IR *BOLETUS EDULIS* BULL.: FR. DERĖJIMUI KERPŠILYJE

S a n t r a u k a

Siekiant išsiaiškinti miško paklotės, samanų dangos ir miško dirvožemio ištrypimo poveikį valgomosios voveraitės (*Cantharellus cibarius*) ir tikrinio baravyko (*Boletus edulis*) derėjimui pietvakarių Lietuvoje buvo atlikti stacionarūs tyrimai. Tyrimų metu nustatyta, kad dėl trypimo sumažėja *C. cibarius* vidutinė vaisiakūnio biomasė ištryptuose sklypuose sekančiais ir vėlesniais metais po ištrypimo. Taip pat pastebėta didesnė vidutinio voveraitės vaisiakūnių kiekio ištryptuose sklypuose priklausomybė nuo intensyviausio grybų derėjimo metu (liepos–rugsėjo mėn.) iškritusių kritulių kiekio (R^2 = 0,89), tuo tarpu kontroliniuose sklypuose ši priklausomybė buvo mažesnė.

Tikrinis baravykas tyrimų metu derėjo labai negausiai, todėl gauti rezultatai yra statistiškai nepatikimi.