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ANALYSIS OF INTERNAL RELATIONSHIPS IN THE FOROPHYTE – ENDOEPIPHYTE MEROCONSORTIUM BY THE EXAMPLE OF THE "*Quercus robur* L., OAK STAND - PATHOGENIC POLYPORACEAE OAK-GROWING COMMUNITY" BIOSYSTEM

ALEXANDR V. DUNAEV[*], VALERIY K. TOKHTAR, ELENA N. DUNAEVA AND ALINA S. KOROTKIKH

Belgorod State University, 85, Pobedy St., Belgorod, 308015, Russia [AVD, VKT, END, ASK].

[[*]For Correspondence: E-mail: Dunaev_A@bsu.edu.ru]

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ABSTRACT

The objects of research were *Quercus robur* L. oak stands with their meroconsortia - communities of oak-growing pathogenic fungi Polyporaceae. The studies were conducted in 2011−2018 in the oak forests of the southwest of the Central Russian Upland. The "oak tree stands - a pathogenic *Polyporaceae* oak-growing community" biosystem can be considered as an example of the "phorophyte – endoepiphyte" cenopopulation meroconsortium. The subsystem of endoepiphyte-meroconsortium is a reflection of the subsystem of phorophyte and can be considered as an independent system if phorophyte is treated as the main environmental factor.

Keywords: Meroconsortium; phorophyte; endoepiphyte; pedunculate oak *Quercus robur* L.; community of pathogenic *Polyporaceae* on oak.

INTRODUCTION

The populational consortium of *Quercus robur* L. includes hundreds of species of different systematic groups. The consorts are distinguished by bioecological similarities, for example, leaf-eating pests of the early spring complex [1] or pathogenic Polyporaceae that cause heart rot of wood [2]. Such private communities can be considered as meroconsortia, and the oak-meroconsortium biosystem at the cenopopulation level as a cenopopulation meroconsortium.

Using the analytical reality idealizing methods in representing this reality and abstracting, we consider the "oak tree stands - a pathogenic Polyporaceae oak-growing community" biosystem as an example of the "phorophyte – endoepiphyte" meroconsortium in terms of the principles of the unity of its existence and internal relationships.

MATERIALS AND METHODS

The objects of the study were oak stands with their meroconsortia - communities of pathogenic *Polyporaceae* growing on oak *Q. robur*. The studies were conducted in 2011−2018 in the oak forests of the southwest of the Central Russian Upland according to an integrated methodology including field (phytopathological, mycocenological and mycopathocenological) methods [2] and analytical (idealization, abstracting, biometrics) methods [3,4, 5,6].

RESULTS AND DISCUSSION

The communities of pathogenic *Polyporaceae* growing on oak *Q. robur* in the oak forests of the southwest of the Central Russian Upland include the following species [5,7,8] *Fistulina hepatica* (Schaeff.) With., *Laetiporus sulphureus* (Bull.) Murrill, *Fomitiporia robusta* (P. Karst.) Fiasson & Niemelä, *Inocutis dryophila* (Berk.) Fiasson & Niemelä, *Pseudoinonotus dryadeus* (Pers.) T. Wagner & M. Fisch., *Daedalea quercina* (L.) Pers., *Hapalopilus croceus* (Pers.) Donk., *Grifola frondosa* (Dicks.) Gray, *Fomes fomentarius* (L.) Fr., *Polyporus squamosus* (Huds.) Fr. Fungus species are named in accordance with the modern nomenclature of basidiomycetes [9], Pinar, & Daglar 2018.

The species core of pathogenic *Polyporaceae* oak-growing communities on oak in oak forests is composed of three species: *Fasciola hepatica, Laetiporus sulphureus*, and *Fargesia robusta*. These species are permanent representatives in the communities and show the highest rates of dominance in terms of abundance, %: 44.9, 28.8, 20.4, respectively, (upland oak forests); 45.0, 26.3, 20.5, respectively, (ravine oak forests) [2,10].

An analysis of the state and development of the "oak tree stands - a pathogenic Polyporaceae oak-growing community" biosystem focuses on the following points.

- The biosystem is developing as a single system in the interaction of two subsystems ("oak tree stands - a pathogenic *Polyporaceae* oak-growing community").
- Each of the subsystems is a "reflection" of the other, and the state of one of the subsystems can show the state of the other.
- Each of the subsystems can be considered as a relatively independent system with its own structure, provided that the other subsystem is treated as the main environmental factor.
- In a biosystem, the subsystem of "oak stand" is dominant on the basis that: 1) pathogenic *Polyporaceae* certainly need the presence of phorophyte, while phorophyte does not necessarily need their presence; 2) phorophyte is a constant phenomenon of material reality, while species of pathogenic *Polyporaceae* manifest themselves with rare exceptions (during the formation of fruiting bodies) in a fairly short time.

Table 1. Internal relationships and interrelations in the "oak tree stand - a pathogenic *Polyporaceae* oak-growing community" biosystem

Oak stands condition indicators	Indicators of relationships and interrelations	Oak-growing pathogenic *Polyporaceae* community condition indicators
CS_{1-6}	$CS_{1-6}(P)$: r=0.391 (t_{exp}=2.547, t_{st}=2.021, k=36, p=0.05); Y=0.0270X+2.2250 $P(CS_{1-6})$: r=0.391 (t_{exp}=2.547, t_{st}=2.021, k=36, p=0.05); Y=5.6510X−5.7327	P
CS_{1-6}	$CS_{1-6}(\mathbf{D}_{Fh})$: r=0.525 (t_{exp}=3.698, t_{st}=2.021, k=36, p=0.05); Y=0.0084X+2.0592 $\mathbf{D}_{Fh}(CS_{1-6})$: r=0.525 (t_{exp}=3.698, t_{st}=2.021, k=36, p=0.05); Y=32.9183X−34.5219	$\mathbf{D}_{Fh}$
N_5	$N_5(P)$: r=0.395 (t_{exp}=2.581, t_{st}=2.021, k=36, p=0.05); Y=0.3311X+4.2873 $P(N_5)$: r=0.395 (t_{exp}=2.581, t_{st}=2.021, k=36, p=0.05); Y=0.4717X+4.7900	P
N_{4-6}	$N_{4-6}(P)$: r=0.462 (t_{exp}=3.130, t_{st}=2.021, k=36, p=0.05): Y=0.7818X+10.7934 $P(N_{4-6})$: r=0.462 (t_{exp}=3.130, t_{st}=2.021, k=36, p=0.05); Y=0.2736X+3.3940	P

Note: CS_{1-6} – value of the weighted average category of the state of viability of oak stands (point); N_5 – current oak tree death rate, %; N_{4-6} – general oak tree death rate, %; P – value the prevalence of pathogenic species *Polyporaceae* on oak (%); D_{Fh} – *Fistulina hepatica* dominance index in the composition of oak-growing communities of pathogenic *Polyporaceae*; r – correlation coefficient; t_{exp} – Student's t-test; t_{st} – critical value of Student's t-test; k – number of degrees of freedom, p – probability of incorrect estimation

The ideas of the dialectical unity and antagonism of the two subsystems formulated in the indicated principle points supplement the data of Table 1, which demonstrates the presence of revealed internal relationships and interrelations in the “oak tree stands - a pathogenic *Polyporaceae* oak-growing community” biosystem.

There is a significant positive correlation between the value of the weighted average category of the state of viability of oak stands ($CS_{1\text{-}6}$) and the total prevalence of oak-growing pathogenic Polyporaceae (P) (see Table 1): r = 0.391 (t_{exp} = 2.547, t_{st} = 2.021, k = 36, p = 0.05). The corresponding relationships are as follows: $CS_{1\text{-}6}$(P): Y=0.0270X+2.2250; R($CS_{1\text{-}6}$): Y=5.6510X−5.7327. That is, we obtain developed statistical (regression) models that reflect the interdependencies between the state of oak stands in oak forests and the overall prevalence of species from the oak-growing communities of pathogenic *Polyporaceae*, which allow us to evaluate each of these values by a change in the other.

There is also a reliable positive correlation between the value of the weighted average category of the state of viability of oak stands ($CS_{1\text{-}6}$) and *Fistulina hepatica* dominance index in the composition of oak-growing communities of pathogenic *Polyporaceae* ($\mathbf{D}_{Fh}$) (see Table 1): r = 0.525 (t_{exp} = 3.698, t_{st} = 2.021, k = 36, p = 0.05). The corresponding relationships are as follows: $CS_{1\text{-}6}$($\mathbf{D}_{Fh}$): Y=0.0084X+2.0592; $\mathbf{D}_{Fh}$($CS_{1\text{-}6}$): Y=32.9183X−34.5219. We also obtain developed statistical (regression) models that reflect the interdependencies between the state of oak stands in oak forests and the *Fistulina hepatica* dominance index, which allow us to evaluate each of these values by a change in the other. Other pairs of indicators can be analyzed similarly (Table 1): $P - N_5$, $P - N_{4\text{-}6}$.

CONCLUSION

Thus, the “oak tree stands - a pathogenic *Polyporaceae* oak-growing community” biosystem can be considered as an example of the “phorophyte – endoepiphyte” cenopopulation meroconsortium. The subsystem of endoepiphyte-meroconsort is a reflection of the subsystem of phorophyte and can be considered as an independent system if phorophyte is treated as the main environmental factor.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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