

FAUNA ACCOMPANYING BRACKET FUNGI *POLYPORUS VERSICOLOR* (L. ex. FRIES) IN THE WILLIAM L. HUTCHESON MEMORIAL FOREST IN NEW JERSEY

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ABSTRACT. *Polyporus versicolor* (L. ex. Fries) is a shelf fungus that occurs on dead tree trunks. Samples were taken over a period of five months from various tree species of different ages and representing the canopy, understory and shrub forest layers. Extraction of organisms took place using modified batteries of Berlese funnels for 72 hours.

Quantities of extracted arthropod species which represented 16 orders and 95 families, varied according to color, size and age of fungi. Acarina, Collembola and Diptera were found to be the dominant occurring orders, Hymenoptera, the least. Correlation between conch infestation and the accompanying fauna, in accordance with the diameter, age, and species of trees, were discussed. Results indicated a clear effect of both microhabitat and fungal age on fauna diversity.

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INTRODUCTION

The economic importance of pore fungi lies in direct use when sold as market commodities. Since the Polyporaceae are wood inhabiting fungi, therefore, the presence of a single bracket or conch on a piece of wood reduces its commercial value. Baxter (1952) estimated that the average percent of cull due to the presence of decay fungi in eastern hardwood forests is 16, in eastern conifer forests 10 and in western conifer 13 percent. However, these figures do not consider the decay in structural timbers, in telegraph and telephone poles, railroad ties, fencing materials and bridge timbers, in lumber yards (Humphrey 1917), pulp mills and a variety of other places.

When the decay fungi attacks slash or other wood parts of economic value, their activities effect its price in markets. The "slash decaying fungi" make it possible for foresters to leave small diameter unusable tree parts after a cutting which these fungi decay thus clearing the woods and allowing for later regeneration. The decay fungi, also play an important role in the carbon cycle. They hydrolyze cellulose and lignin to simpler suitable substances which they use in respiration. Thus a portion of the degraded cellulose or lignin is released to the atmosphere as carbon dioxide, becoming available to green plants as a raw material for photosynthesis.

Many soil microfauna such as soil mites, of the Cryptostigmata are specific fungivores. Collem-

bola and Acarina constitute 75% to 80% of the total number of soil arthropods (Thompson 1924; Edwards 1929; Ford 1935, 1938; Bawiga 1939; Salt et al. 1948; MacFayden 1952; Hartstein 1961; Tadros et al. 1978 and Tadros, 1980). Evans (1955) recorded 2.5 mites/cc of soil in a spruce plantation, while Wallwork (1957) estimated it 2.35 mites/cc in a hemlock forest. Later, Mitchell (1979) states that among soil arthropods, mites represent the most diverse and numerous taxon and that oribatids form the majority of the Acari. The role of soil fauna in the decomposition of organic matter is not yet so clear, it is believed that the fauna feeds on organic matter following initial microfloral degradation. Most of these organisms are beneficial in promoting soil fertility through accelerating decay of cellulose and wood. Thus, the density of these organisms is an important factor in soil formation.

In the present investigation the occurring of fauna with the decaying fungi conch may clear the competition and diversery between arthropod species and food chain in nature.

The objectives of the present investigation are: (a) to record fauna accompanying punk (*Polyporus versicolor* L. ex. Fries) at three periods of its age, either on oak trees representing the majority of the overstory, or, the flowering dogwood and black cherry, representing the forest understory, and (b) to examine fauna existing in soil around the same tree trunks infested by conch, and (c) to find out if there is any diversery between fauna species occurring in or on bracket, bark or soil.

THE STUDY SITE

The William L. Hutcheson Forest (40° 30' N., 74° 34' W) is a mixed oak woods of 67 acres located one mile east of Millstone on the Piedmont in New Jersey, U.S.A. The forest has been preserved since the appearance of the white man in North America and serves as an excellent area for the study of soils under natural conditions and is an example of a stand that has been protected for more than 250 years (Buell et al., 1954; Buell, 1957). The forest is described as a mosaic of small patches created by tree falls (Lang et al., 1978), occurring within a larger closed-canopy forest matrix. The many gaps in the overstory are due to the natural fall of both living and dead large,

mature trees (Reiners & Reiners, 1965). The white oak (*Quercus alba*, L.), red oak (*Quercus borealis*, Michx), black oak (*Quercus velutina*, Lam.), and red hickory (*Carya ovalis*, Wang.) dominate the overstory with a maximum height of 95 feet (Bruce, 1967). The understory is made up of flowering dogwood (*Cornus florida* L.) with a maximum height of 35 feet. The shrub layer consists primarily of maple-leaved viburnum (*Viburnum acerifolium* L.) (Bard, 1952; Buell, 1957; Monk, 1957 & 1961; Salzer, 1971; Forman et al., 1975; and Lang et al., 1978). The herb layer is best developed in Spring when mayapple (*Podophyllum peltatum* L.) is abundant (Monk, 1961; Bruce, 1967). Ugolini (1964) states that the upland section of the forest is classed as a deep, well-drained silt loam. The soil has a characteristic red color.

METHODS AND TECHNIQUE

Bark samples were collected from May through September, 1980 from either bracket infested standing or fallen black oak trees *Quercus velutina* (Lam) at different diameters and three different ages, or, from other forest trees. It was planned that those samples would cover the wide diversity of trees growing in the forest, whenever possible. It was essential also to take soil samples from around tree trunks for comparison of fauna living in soil, or conch or on the bark of the same trees infested by bracket. Conch was collected from trees by hand, kept in tight plastic bags, transported directly to laboratory for examination. To remove bark from the infested trees, an ordinary axe was used.

Soil samples were taken up to 5 cm deep with an iron cylinder, adapted from that described by Auerbach et al. (1960).

Batteries of modified Berlese funnels with 60 watt bulbs were used for the extraction of organisms. Extraction took place for 3-4 days. Organisms were collected in vials containing 70% ethanol.

RESULTS

(a) Total fauna existing on conch, bark and soil:

It was found out that organisms occurring on *Polyporus versicolor* were all arthropods of sixteen orders and 95 families. Results indicate that the younger the conch, the higher percentage of

TABLE (1): The correlation between conch age and percentage of fauna infestation to bracket.

	CONCH AGE		
	1st Mature expanding	2nd Mature Sporulation	3rd Mature Sporulation completed
BRACKET AREA (square cm)	2.58 — 7.74	3.87 - 16.77	4.51 — 17.42
FAUNA INFESTATION %	78.09	15.62	6.29

the organisms was extracted. These results (Table 1) may be due to suitable atmosphere, humidity, soft food and shelter offered at that age of conch.

Comparing total fauna occurring on bracket, infesting black oak trees *Quercus velutina* (Lam.), (Table 2) data indicated that, the larger diameter the tree is, the high fauna infestation happened. This result may be due to the large area of aged trees that offered room for organisms to prevail, especially with those wandering species, such as oribatids (Aoki, 1971).

Table (2) indicates fauna infestation in three sites; soil, bark and bracket. It is obvious that bracket was the favoured site in the four tested tree species, nevertheless of conch age, followed by bark, while soil was the least infested site. These results may be due to the structure of conch, since there are many pores on its lower surface,

that provide shelter to many microorganisms from predators. In this investigation a large fraction of the extracted soft bodied acarina were predators, or rather cheyletid mites. It is also known that many fauna species are fungi feeders. The many grooves occurring in bark may also be considered as another extra site for these organisms to wander. Bark came second in rank followed by soil, the least favored in this category.

Infestation of fauna to various tree barks (Table 3), proved not to be alike, however, dogwood. *Cornus florida*, was the least favored tree, followed by black cherry *Prunus serotna*, while black oak *Quercus velutina*, was the much favored. In spite of this result, a negative correlation was clear between tree infestation and its diameter. Dogwood which was only 8 cm in diameter was more highly infested by bracket than any other

TABLE (3): Correlation between fauna existing in or on one dry gram of soil, bark or bracket in 3 kinds of trees infested by conch.

VEGETATION	SITE	INDIVIDUAL/1 GM. OF DRY MATERIAL		
		SOIL	BARK	BRACKET
DOGWOOD <i>Cornus florida</i> (L.)		0.12	0.89	0.75
BLACK CHERRY <i>Prunus serotina</i>		0.18	1.44	1.55
BLACK OAK 3rd Age of Bracket <i>Quercus velutina</i> (Lam.)		0.15	2.70	3.10
BLACK OAK 2nd Age of Bracket		0.56	1.80	7.70
BLACK OAK 1st Age of Bracket		0.28	3.04	38.50

TABLE (2): Means of various fauna orders occurring in soil or on either bracket or bark of trees representing the main vegetation in the William L. Hutcheson Memorial Forest in New Jersey.

FAUNA ORDERS	MAIN CANOPY												UNDERSTORY			SHRUB											
	BLACK OAK <i>Quercus velutina</i>						WHITE OAK <i>Q. alba</i>						DOGWOOD <i>Cornus florida</i>			BLACK CHERRY <i>Prunus serotina</i>											
	1st age			2nd age			3rd age			S.			B.			F.			S.			B.			F.		
	S.	B.	F.	S.	B.	F.	S.	B.	F.	S.	B.	F.	S.	B.	F.	S.	B.	F.	S.	B.	F.	S.	B.	F.			
1	5	6	0	0	0	5	0	0	0	0	0	2	30	0	0	21	0	0	8	0	0	0	8	0	0		
2	6	2	75	22	0	50	0	5	17	0	0	6	2	15	7	0	1	10	0	6	10	0	0	0	6		
3	0	2	7	5	2	55	0	10	3	0	0	3	0	10	2	11	4	0	0	0	0	0	0	0	2		
4	0	5	5	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	2	3	4	10	0	0	0	1	2	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	
6	11	21	85	14	384	505	14	15	10	15	10	12	95	150	4	24	4	7	67	21	7	67	21	7	67	21	
7	9	19	90	8	603	35	3	10	4	3	4	33	204	8	2	20	6	5	45	2	5	45	2	5	45	2	
8	0	2	0	0	0	0	0	2	4	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
9	0	2	0	5	0	0	0	7	3	0	0	0	22	0	0	3	0	0	3	0	0	0	3	0	0	0	
10	0	5	0	6	0	0	0	3	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	3	5	3	2	2	0	2	0	0	2	2	50	80	0	22	0	0	2	0	0	0	2	0	0	0	
12	6	6	3	0	8	3	3	4	0	3	4	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	37	76	270	73	997	655	20	60	43	63	436	1055	15	102	15	14	125	34	14	125	34	14	125	34	14	125	34
ORGANISMS/1 gm DRY MATERIAL	0.28	3.04	38.50	0.65	1.80	7.70	0.15	2.70	3.10	0.48	1.40	35.20	0.12	0.89	0.75	0.18	1.44	1.55	0.18	1.44	1.55	0.18	1.44	1.55	0.18	1.44	1.55

S.: SOIL
 B.: BARK
 F.: BRACKET FUNGI

TABLE (5): Percentages of various insect orders occurring in bracket infesting different kinds of trees.

ORDERS	ACARINA	DIPTERA	COLLEM.	PSOCOPTERA	COLEOPTERA	LEPIDO.	HEMIPTERA	THYSANOP.	ORTHOPTERA	HYMENOP.	OTHER ORDERS
%	60.97	12.12	11.40	6.85	6.37	0.63	0.47	0.39	0.31	0.25	0.24

TABLE (4): Percentage of Acarina and Collembola to the total extracted microfauna in three microhabitat.

LOCATION	% ACARINA: TOT. FAUNA	% COLLEMBOLA: TOT. FAUNA
IN SOIL	24.00	14.50
ON CONCH	48.00	38.60
BARK	33.76	50.19

kind of tree in the forest, while the black oak which reached a diameter of approximately 25 cm was less infested by conch. On the other hand, the conch in the black oak (low infestation) showed a higher infestation of microfauna, than in dogwood. This result may be due to cell structure of the two kinds of trees, tree odor, bark grooves, striations, water content, etc. and those points need further investigation. Coleoptera infested only dogwood while Collembola and Acarina were dominant in all samples, even if they varied in infestation level.

(b) The diversity of fauna

Results (Table 2) indicated that fauna occurred in the four tested kinds of trees either in their bark, bracket or in soil around tree trunks.

1. Kind of tree

Results in (Table 3), indicated that there was no clear preference of fauna to any kind of the five tested tree species, however, black oaks were the much favoured, while dogwood, the least.

2. Location of occurring fauna

Collembola and Acarina are the most common

insects or animals found in forest soils (Dindal et al., 1979). In the present investigation, results (Table 4) confirmed Dindal's findings, however, Collembola preferred bark (50.19%) followed by Conch (38.60%) while its level in soil was not so high (14.50%). Acarina preferred the fungi bracket reaching a rate of (48.00%) followed by bark (33.76%), while soil came third in rank (24.00%). This result may be attributed to the fact that many fauna species are fungi feeders and perhaps, the good shelter, porosity, aeration, and atmosphere would be much better than offered in soil. Predators may be another reason, since many acarina species met with were predaceous mites (Cheyletidae). Individuals belonging to Thysanoptera (thrips) were also found in reasonable numbers and it is known that many of them feed on fungus spores and a few are predaceous on other small arthropods.

(3) Fauna Order and infestation location.

The preference of insect and mite fauna orders to bracket, infesting various tree species, (Table 5) indicates a slight difference, acarina was the most

TABLE (6): Percentages and means of various fauna orders occurring at three forest locations; soil, bark and bracket.

LOCATION	SOIL		BARK		BRACKET	
	Mean	%	Mean	%	Mean	%
THYSANOPTERA	7	2.99	65	3.65	5	0.39
DIPTERA	51	21.79	9	0.50	154	12.12
COELOPTERA	10	4.27	25	1.14	81	6.37
LEPIDOPTERA	0	0.00	5	0.28	8	0.63
HEMIPTERA	16	6.84	4	0.22	6	0.47
ACARINA	62	26.50	588	33.06	775	60.97
COLLEMBOLA	60	25.64	901	50.65	145	11.40
ORTHOPTERA	3	1.28	5	0.29	4	0.31
HYMENOPTERA	5	2.14	37	2.08	3	0.25
PROTURA	6	2.56	33	1.85	0	0.00
PSOCOPTERA	5	2.14	81	4.55	87	6.85
OTHER ORDERS	9	3.85	26	1.46	3	0.24

dominant order (60.97%) followed by Diptera (12.12%) while Collembola came third (11.40%). The other seven discussed orders ranged in their occurrence from (6.85% - 0.25%). Other insect orders (0.24%), included individuals from orders Zoraptera, Mecoptera, Aranida, Pseudoscorpionida, Dermaptera, Myriapoda and Isopoda. This result, confirms the diversery of animals.

Table (6) indicates the diversity of the sixteen orders occurring in soil-bark, or bracket. Data indicated that springtails were the dominant organisms in bark (50.65%) followed by acarina (33.06%). On the other hand, soil fauna indicated that two orders were the most dominant, i.e., acarina (26.50%), and Collembola (25.64%). In the bracket fungus, as in the soil, Acarina ranked first, and Collembola third. Another order (Diptera) was intermediate in abundance. The appearance of dipterous organisms in the forest site may be due to the offered shelter in the three sites since they are important food of many larger animals. Many species are also parasitic or predaceous on other insects; and are of value in keeping noxious species under control; others are of value as scavengers.

SUMMARY

A survey of the fauna accompanying conch *Polyporus versicolor* (L. ex. Fries) infesting either black oak trees or other kinds of trees in the William L. Hutcheson Memorial Forest in New Jersey was carried on. A survey was also done to fauna occuring either on bark, or from soil around the tree trunks infested by conch.

Results indicated that all extracted organisms belongs to one phylum, Arthropoda, sixteen orders and 95 families. Acarina, Collembola, and Diptera were the dominant orders occuring in the three tested sites. Data indicated a difference in fauna level according to tree kind, tree diameter, bracket infestation or age.

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