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ZOOLOGY

SURVEYING THE ACAROFAUNA ASSOCIATED WITH POLISH *SCOLYTIDAE*

by

BOHDAN KIEŁCZEWSKI[1], JOHN C. MOSER[2] AND JERZY WIŚNIEWSKI[1]

[1] Chair of Forest and Environment Protection, Academy of Agriculture, Wojska Polskiego Street 71c 60-625 Poznań
[2] Southern Forest Experiment Station, Forest Service — USDA, Pineville, La. 71360 U.S.A

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Abstract: One hundred eighty-one mite species from 45 bark beetle species were collected from 40 sampling areas representing the major phytosocial communities in Poland. Most mite species were characterized by their adaptability to various environments.

INTRODUCTION

Scolytid-associated mites were first investigated by Vitzthum (1923, 1926). But, until 1970 these studies were limited to taxonomic surveys or to biological observations of certain groups (Lindquist, 1969).

Boss and Thatcher (1970) and Kinn (1971), surveying bark beetles in the Western United States, first discussed the feeding habits and ecological roles of mites associated with bark beetles. The first comprehensive surveys for mite associates of single bark beetle species were for the western pine beetle, *Dendroctonus brevicomis* LeConte, 1876, (Kinn, 1970) and for the southern pine beetle, *Dendroctonus frontalis* Zimmerman, 1868, (Moser and Roton, 1971).

This paper is the first attempt to define feeding habits and ecological roles of mites associated with bark beetles in Europe. The report is one of a series launched by a cooperative study * to record bark beetle acarofauna of Poland (Kiełczewski, 1976; Kiełczewski and Wiśniewski, 1978, 1980. In press a,b).

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MATERIALS AND METHODS

One hundred eighty-one mite species were taken from galleries of 45 bark beetle species (Table 1) (Kiełczewski, 1976). Sampling areas were in 40 national parks, reservations, and managed forests throughout Poland. These areas were grouped by phytosocial communities according to Braun-Blanquet's (1964) classification scheme.

The bark was brought to the Chair of Forest and Environment Protection in Poznań, where beetles and galleries were examined. Using de Fauré's or Berlese's solutions, researchers mounted most of the mites on slides. But some material was held for rearing if mites were mostly in immature stages. In two instances researchers forwarded live populations of *Pyemotes dryas* (Vitzthum, 1923) to the United States, so possibilities of introducing this mite for biological control of the southern pine beetle could be investigated (Moser et al., 1978).

RESULTS AND DISCUSSION

Of the 181 mite species found, 11 were new species in the following genera: *Dendrolaelaps*, Wiśniewski (1979c); *Proctolaelaps*, Wiśniewski (1979b); *Trichouropoda*, Wiśniewski (1977);Hirschmann (1978a, 1978b); *Uroobovella*, Wiśniewski (1979a); and *Histiogaster*, Kiełczewski and Wiśniewski (1975).

Eighty-four species belonged to the Mesostigmata (of which 21 were in the Uropodina), 15 to the Tarsonemini, 12 to the Prostigmata, 23 to the Acaridiae, and 47 to the Oribatei. Although time and facilities did not permit statistically valid sampling of all bark beetle galleries, those of some bark beetles apparently contained more mite species than others. Mites were most abundant in galleries of *Tomicus piniperda*, followed by *Hylurgops palliatus*, *Tomicus minor*, *Ips typographus*, *Pityogenes chalcographus*, *P. bidentatus*, *Hylurgus ligniperda*, and *Hylastes ater* (Table 1).

Mite genera most frequently seen in galleries were *Dendrolaelaps* (23 species), *Trichouropoda* (12 species), *Pergamasus* (10 species), *Histiostoma* (9 species), and *Proctolaelaps* (7 species). Many of these species were also found in North America. No important association of mites with separate phytosocial communities was detected; most occurred in many habitats. Frequency of the 181 mite species varied greatly. *Proctolaelaps fiseri* Samsinak 1960 was found most often, appearing in galleries of 28 bark beetle species. *Trichouropoda obscura* (C. L. Koch, 1836) was next found in galleries of 18 beetle species, followed by *Lasioseius ometes* (Oudemans, 1903) in 17, *Proctolaelaps rotundus* (Hirschmann, 1962) in 13, *Dendrolaelaps tenuipilus* Hirschmann 1960 in 10, *Para-*

leius leontonychus (Berlese, 1910) in 9, *Scheloribates latipes* (C. L. Koch, 1841) in 9, *Trichouropoda ovalis* (C. L. Koch, 1839) in 8, *Dendrolaelaps cornutus* (Kramer, 1886) in 8, *Trichoribates trimaculatus* (C. L. Koch, 1836) in 7, *Amblydromella richteri* (Karg, 1970) in 7, *Carabodes labyrinthicus* (Michael, 1879) in 7, and *Cymbaeremaeus cymba* (Nicolet, 1855) in 7.

Noted were also developmental problems of uropodid mites (Kiełczewski and Wiśniewski, 1977b), disturbances in mite metabolism (Kiełczewski and Wiśniewski, 1977c), and certain morphological changes in mites (Kiełczewski and Wiśniewski, 1977a, 1979).

Of prime interest were the many parastic mite species. *Pyemotes dryas* was found with *Polygraphus poligraphus, Pityogenes chalcographus*, and *P. bidentatus; Pyemotes scolyti* (Oudemans, 1936) with *Scolytus scolytus* and *Pyemotes herfsi* (Oudemans, 1936) with *Tomicus piniperda, T. minor,* and *Scolytus scolytus.* Although *Pyemotes* were detected infrequently in galleries, when they were abundant they accounted for high beetle mortality. But large populations of these mites were seen only during spring and fall. And our host records show for the first time that the ubiquitous *P. herfsi* can parasitize field populations of bark beetles.

Paracarophaenax ipidarius (Redikorzev 1947) was originally found in Russia as females phoretic on *Ips typographus.* We also found this species as females phoretic on *Ips typographus,* as well as in galleries of *Ips cembrae.* Although we did not observe feeding, studies of two related species (Cross, 1965) suggest that female mites feed on eggs of at least *Ips bark* beetles. Another egg parasite, *Iponemus gableri* (Schaarschmidt, 1959) was seen in galleries of *Ips typographus.* According to Bałazy (1968), *I. gableri* accounts for about 7 percent mean mortality of bark beetle eggs in Polish spruce forests. Sometimes, but rarely, most eggs are killed (Gäbler, 1947).

Forty-seven oribatids were found in galleries, although their role in the subcortical niche is poorly understood (Kiełczewski and Wiśniewski, 1978). The oribatids' main habitat is forest litter, but they are sometimes numerous on trunks, branches, and leaves of trees (Kiełczewski and Seniczak, 1971). Many are fungivorous, perhaps transmitting various decay organisms and disease of forest trees. Moser and Roton (1971) reported that oribatids rarely occurred in samples and presumably migrated from bark scales, which they normally live under. But bark-beetle-infested trees have more oribatids than healthy trees have. In part, the greater number may be due to phoretic tendencies of some species. One of these is *Paraleius leontynychus* Berlese, 1910, associated with nine unrelated bark beetle species from numerous localities. Moser (in Norton, in preparation) records *P. leonto-*

Table 1
Numbers of mite species recovered from galleries of various bark beetles

Bark beetle species	Number of mite-species from					
	Meso-stigmata	Tarso-nemini	Prosti-gmata	Acari-diae	Oriba-tei	Total
Hylastes ater (Paykull, 1800)	9		1		5	15
Hylastes brunneus (Erichson, 1836)				1		1
Hylastes cunicularius (Erichson, 1836)	1					1
Hylastes opacus (Erichson, 1836)	3					3
Hylurgops palliatus (Gyllenhal, 1813)	27	1	4	5	9	46
Tomicus piniperda (Linnaeus, 1758)	36	3	3	5	18	65
Tomicus minor (Hartig, 1834)	20	1	2	5	7	35
Hylurgus ligniperda (Fabricius, 1792)	17		3		1	21
Polygraphus poligraphus (Linnaeus, 1758)	6	1		1	4	12
Phloeosinus thujae (Perris, 1860)					4	4
Hylesinus varius (Fabricius, 1775) (=*Leperisinus fraxini* (Panzer, 1799))	3		1	1	2	7
Trypodendron lineatum (Olivier, 1795)	5		1			6
Trypodendron signatum (Fabricius, 1787)	3				1	4
Crypturgus pusillus (Gyllenhal, 1813)	2	1	1	2	2	8
Crypturgus hispidulus (Thomson, 1870)					1	1
Crypturgus cinereus (Herbst, 1793)	6					6
Ernoporus tiliae (Panzer, 1793)	1	1				2
Cryphalus piceae (Ratzeburg, 1837)	4					4
Cryphalus asperatus (Gyllenhal, 1813)	2				3	5
Cryphalus intermedius (Ferrari, 1867)	5			1	1	7
Dryocetes autographus (Ratzeburg, 1837)	9			2	4	15

contd 1

Bark beetle species	Number of mite-species from					
	Meso-stigmata	Tarso-nemini	Prosti-gmata	Acari-diae	Oriba-tei	Total
Dryocetes hectographus (Reitter, 1913)	1			2		3
Dryocetes alni (Georg, 1856)					2	2
Xyleborus saxeseni (Ratzeburg, 1837)				1		1
Xyleborus cryptographus (Ratzeburg, 1837)	2					2
Taphrorychus bicolor (Herbst, 1793)	2		1		2	5
Pityophthorus pityographus (Ratzeburg, 1837)	2				5	7
Pityogenes chalcographus (Linnaeus, 1761)	10	4	1	2	8	25
Pityogenes bidentatus (Herbst, 1783)	13	4		1	7	25
Pityogenes quadridens (Hartig, 1834)	1					1
Pityokteines curvidens (Germar, 1824)	3			1		4
Pityokteines spinidens (Reitter, 1894)	3					3
Pityokteines vorontzovi (Jacobson, 1893)	6					6
Orthotomicus laricis (Fabricius, 1792)	7				1	8
Orthotomicus suturalis (Gyllenhal, 1777)	3		1	1		5
Ips acuminatus (Gyllenhal, 1827)	1	2			2	5
Ips sexdentatus (Boerner, 1776)	4			1		5
Ips typographus (Linnaeus, 1758)	11	5	1	1	7	25
Ips cembrae (Heer, 1836)	4	1				5
Ips amitinus (Eichhoff, 1872)	1				1	2
Scolytus multistriatus (Marsham, 1802)	5			1	4	10
Scolytus scolytus (Fabricius, 1775)	4	2		1		7
Scolytus ratzeburgi (Janson, 1856)	1					1
Scolytus rugulosus (Muller, 1818)	1					1
Scolytus intricatus (Ratzeburg, 1837)	3					3

nychus phoretic on *Dendroctonus frontalis* and *Hylastes salebrosus* near Pineville, La., on *Dryocoetes affaber* in Fairbanks, Ak., and on *Hylastes nigrinus* in Otis, Or.

Bałazy et al. (1977) review many spore forms detected on mites. Although earlier works emphasize beetle transmission of spores, Kiełczewski et al. (1973), stresses the importance of mites as carriers; many spore types were found that were potentially capable of affecting beetle populations or tree health. Prominent among these were the highly specialized "nematode-killing species", *Monacrosporium, Dactylaria*, and *Trindentaria*. The *Thaxteriolae* group, which parasitized a variety of mite species, was also important. Majewski and Wiśniewski (1978a) described a new genus and three new species. Fungi of this group appear to be universal, having been found associated with bark beetle mites in Louisiana (Majewski and Wiśniewski, 1978b) and with Uropodina deutonymphs on insect species in New Guinea (Majewski and Wiśniewski (Unpublished)).

The *Entomophthoraceae*, highly pathogenic to insects, were carried by mites at least once. Several hundred spores of *Tarichium svalbardense* (Sig Thor) were identified from the body of the mite *Veigaia* sp. (Bałazy and Wiśniewski, 1978). This fungus had previously been found on Spitzbergen Island and in Czechoslovakia.

The association of *Tarsonemus ips* Lindquist, 1969 with *Ips typographus* and *Pityogenes chalcographus* may indicate the presence of tree pathogens. Moser and Roton (1971) found that *T. ips* fed on and transmitted *Ceratocystis*. *Tarsonemus subcorticalis* Lindquist, 1969, also associated with *P. chalcographus*, may have similar habits. Francke-Grosmann (1967) lists 11 species of *Ceratocystis* associated with bark beetles in Europe, 6 of which were found with *Ips typographus* or *P. chalcographus*. Those six, at least, may be transmitted by tarsonemid mites.

CONCLUSIONS

Our survey detected no significant association of mites with separate phytosocial communities; in fact, most species were characterized by their adaptability to various environments. Although some mites, such as the parasites, obviously reduced beetle populations, other effects were more obscure. In fact, several species once assumed to be beetle predators, may benefit beetles by reducing nematode parasites such as *Contortylenchus* (Kinn, 1967, 1971; Kinn and Witcosky, 1977). Similarly, fungi are important to bark beetles not only as symbionts in beetle mycangia (Batra, 1963, Francke-Grosmann, 1956), but also as competitors (Barras 1970), and as tree diseases such as *Ceratocystis* (Francke-Grosmann, 1967).

Future studies, then, will have to concentrate on the relationships of all fauna microflora beneath the bark. Such studies can assess roles of single mite species as possible bases for biological control of bark beetle pests.

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