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# Association of *Ovalisia rutilans* (Fabricius, 1777) (Coleoptera: Buprestidae) with thermophilous habitats toward its range edge in northern Poland

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The occurrence of *Ovalisia rutilans*, an endangered beetle developing in lime trees, was studied in a network of rural avenues in northern Poland. We examined 2052 small-leaved lime trees (*Tilia cordata*) planted along road verges. Among them, 32 trees (1.54%) were occupied by *O. rutilans*. The beetle preferred trees of worse health class.Trees planted along asphalted roads were more often occupied than those along roads of other surface. In turn, the distribution of *O. rutilans* was random with respect to trunk size. We conclude that the occurrence along asphalted roads might compensate for the colder climate in the northern part of its distribution range.

Key words saproxylic beetle, rural avenues, *Tilia cordata*

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## INTRODUCTION

The Linden burncow *Ovalisia* (*Scintillatrix*) *rutilans* (Fabricius, 1777) occurs in the warmer parts of the western Palaearctic. The species was recorded from the Transcaucasian region, the forest-steppe zone of the former USSR, Crimea, southern and central Europe and north-western Africa (Richter 1952, Burakowski et al.1985, Bílý 1989). In the Baltic region, the beetle was found in southern Norway and Finland (probably introduced), Germany, Poland and Lithuania (Heimbucher 1998, T. Ranius, D.Telnov, pers. com.). No data are available from Latvia, Sweden, Estonia and Denmark (Telnov et al. 1997, Kubán 2005). Hence, European range sizes are still insufficiently known.

The species, like many other saproxylic organisms, seems to be under threat as the number of potential habitats decreases. It is listed as endangered in the German Red Data Book (Geiser et al. 1984). The Polish localities of *O. rutilans* have been summarized in previous

publication of Burakowski et al. (1985) and date mostly before1980. Newer records are scarce. The species was recorded in nearly all parts of Poland; however it seems to be more abundant in the warmer, southern parts (Fig. 1). Due to these limited data it is difficult to assess the habitat preferences of *O. rutilans* in detail. Here we present data on ecological preferences of *O. rutilans* from a network of rural country roads in Northern Poland.

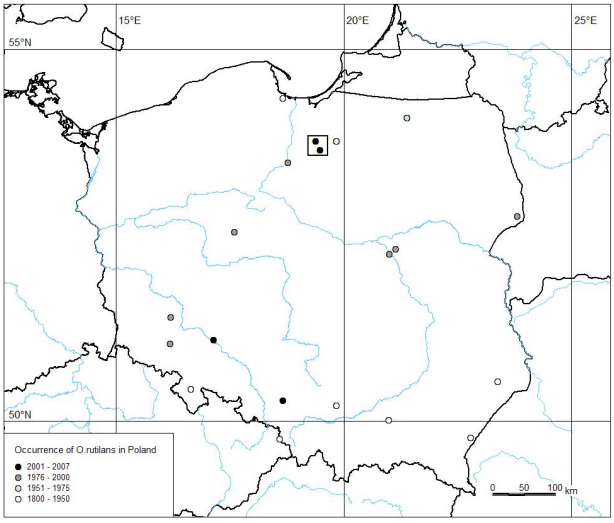


Fig. 1. Occurrence of *Ovalisia rutilans* in Poland (according to Burakowski et al. 1985, Gutowski & Ůugowoj 2000, Z. Chrul, J. Kurzawa, K.Maciejewski, pers.com. – see Appendix). The square indicates the study area.

Table 1. Physical characteristics of trees

| Name | Description |
|---|---|
| healthy state | The health state of trees according to Pacyniak (1992): 1 – trunk and crown healthy; 2 – hollows present, up to 25% of crown damaged (los 3 – 25-50% damaged (loss); 4 – 50-75% damaged (loss); 5 – above 75 damaged (loss) or a dead tree |
| circumference | Trunk circumference at breast height with accuracy to the nearest 10 c (cm) |
| road surface | dirt (coded 1), brick paving, concrete plates (2), asphalted (3) |

## MATERIALS AND METHODS

The occurrences of *O. rutilans* were studied in the Iława Lakeland Landscape Park (NE Poland, Fig. 1), which is a rural landscape rich of old avenues. For this study we choose 57.5 km of avenues making up over 20% of all old avenues in that area and examined 2052 small-leaved lime trees (*Tilia cordata*) and 1646 trees of other species in July 2003 and 2004. We regarded trees as being occupied by *O. rutilans*

Table 2. Colonization of lime trees by *Ovalisia rutilans* in comparison with tree circumference

| Tree circumference class, cm | Number of trees without *O. rutilans* | Number of trees with *O. rutilans* |
|---|---|---|
| 10 - 30 | 137 | 1 |
| 31- 60 | 397 | 4 |
| 61 - 90 | 764 | 16 |
| 91 - 120 | 448 | 5 |
| 121 - 150 | 116 | 6 |
| 151 - 180 | 19 | 0 |
| 181 - 210 | 8 | 0 |

Table 3. Differences between observed and expected occupancies of trees according to road surface material. Expected occupancies were obtained by a random sampling of 32 trees (the actual number of *O. rutilans* found) out of the total number of lime trees (2077). Means and standard deviations of the expectation were estimated from 5000 replicates

| Road surface type | Number of lime trees | Trees with *O. rutilans* | Expected number of occupied trees | SD of expected value | Z | p |
|---|---|---|---|---|---|---|
| dirt road | 1309 | 7 | 20.17 | 4.46 | -2.95 | 0.003 |
| brick paving | 7 | 0 | 0.11 | 0.33 | -0.33 | 0.74 |
| concrete plates | 185 | 4 | 2.85 | 1.68 | 0.69 | 0.49 |
| asphalted | 576 | 21 | 8.87 | 2.96 | 4.10 | <0.0001 |
| Total | 2077 | 32 | | | | |

if emergence holes and larval tunnels were found under the tree bark. The horizontal mergence holes are oval with an opening of app. 3 x 6 mm. No other beetle species in northern Poland produces such holes. In most instances we found also adults. We used the 5 point scale of Pacyniak (1992) to assess tree health (lower levels denote healthier trees, Tab. 1). Trunk circumference was measured at a height of 1.3m. Avenues were classified according to road surface type, average number of potential host trees (limes), average tree health, and the number of trees occupied by *O. rutilans*.

We used multiple logistic regression with log-transformed predictor variables to infer differences in occupancy due to circumference, health class, and road surface.

Occurrences of *O. rutilans* with respect to tree species, circumference and health state were also compared to a random sample of the observed number of Linden burncow beetles from the total number of trees examined. Expected frequencies, standard deviations, and normalized $Z$–scores ($Z = [x - \mu] / \sigma$) were generated from 5000 random samples each using the program Sample (Ulrich 2003, Ulrich & Ollik 2005). $Z$–scores above 1.96 or below –1.96 point to significant ($p < 0.05$) deviations of the observed value $x$ from the expectation ?.

## RESULTS

*O. rutilans* occurred in 32 of the 2077 lime trees (1.54% of all lime trees were occupied). Other tree species were not occupied. The beetle preferred trees with a circumference between 120 and 150 cm ($Z=2.81$, $p=0.005$, Tab. 2). Occupancy of other girth classes did not differ from the expected values of the random sample model. Further, *O. rutilans* occurred more often in trees of the worse health class 5 as inferred from a comparison of occurrences with a random sample of 32 trees out of the total number of lime trees inspected ($Z=2.51$, $p=0.01$). Completely healthy trees (class

Table 4. Results from logistic regression analysis to infer the dependence of *O. rutilans* on road surface type, tree circumference and health state. Significance of the total model: $Chi^2(3)=41.95$, $p<0.0001$

| Factor | Value | Standard error | Wald Chi-Square | p |
|---|---|---|---|---|
| Constant | -8.37 | 0.94 | 79.28 | <0.0001 |
| Circumference | 0.008 | 0.007 | 1.36 | ns |
| Health | 0.53 | 0.19 | 7.24 | <0.01 |
| Road surface | 1.23 | 0.19 | 30.05 | <0.0001 |

1) were less occupied than predicted from the random sample model (Z=-2.01, p=0.04). We found no deviations from the model in other health classes.

We observed a strong preference for asphalted roads (Z=4.10, p<0.0001) and an avoidance of dirt roads (Z=-2.95, p=0.003; Tab. 3). Logistic regression pointed to tree health and road surface as main factors influencing occupancy of trees (Tab. 4).

## DISCUSSION

*O. rutilans* is an extremely rare species in Northern Poland. In the region, we have never found it on trees outside road verges. In the study area *O. rutilans* did not occur in tree species other than lime, although Richter (1952) claimed that beech and elm can serve as alternative hosts. According to Zykov (1984) these records might be based on misidentifications of other European species like *Ovalisia mirifica* (Mulsant 1855) .

In line with Zykov (1984) we found O. rutilans in trees of all health classes, but the beetle seems to prefer trees of worse health state. However, it remains unclear whether the species chooses health trees and harms them or whether it needs previously weakened limes. We never found the beetle in completely dead trees.

*O. rutilans* prefers limes growing in warm places. In our study area the beetle obviously reached higher occupancies in trees planted along asphalted roads. These findings are in line with previous studies that reported the occurrence of *O. rutilans* along roadsides. So far the species was recorded in clear-cuts in the Voronezh Province in Russia (Zykov 1984), along lime alleys in Prague (Rejzek 2001) and Budějovice in the Czech Republic (Kletečka 1995), and in limes planted on embankments of the Odra river in Poland (R. Królik, pers. com.). Roadside lime trees may be preferred because the black road surface warms up stronger. Despite of intensive search, we have never found *O. rutilans* in other habitats. Moreover, relatively colder dirt-road avenues were apparently avoided (Tabs. 3, 4). This pattern may be a way to compensate the colder climate in the northern parts of its distribution range.

Burakowski et al. (1985) claimed that larval development takes 2-3 years in Central Europe, but only one year in the south of the continent. This suggests that its distribution range may be limited by thermal conditions. In northern Poland the species seems to be restricted to the most isolated tree stands. In contrast, in the milder climate of Hungary *O. rutilans* is a widespread species (Muskovits & Gábor 2002). Such a restriction of species to thermophilous microhabitats towards their northern range edge was previously reported for butterflies (Thomas 1993), ground beetles (Telfer & Eversham 1996) and some saproxylic beetles, e.g. the hermit beetle *Osmoderma eremita* (Ranius & Nilsson 1997). As the species is restricted to distinct microclimatic conditions, it may play role as an indicator of warmer stands which are important for the preservation of saproxylic organisms. Further studies are necessary to determine whether the occurrence of *O. rutilans* may serve as an indicator of species richness of thermophilous saproxylic organisms.

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**Appendix** – New localities of *Ovalisia rutilans* from Poland

Białowieża Forest: ad Pogorzelce, SD84, 30.06.1994 – forest edge, 1 ex., Konrad Maciejewski leg.

Masurian Lakeland: Iława Lakeland, Szymbark, CE94, Kamieniec, CE95, July 2003 – 2007, lime trees in rural avenues, A.Oleksa & R.Gawroński leg., obs.

Lower Silesia: Wrocław – Wojnów, XS56, 1 ex, 28-29.05.2003 – forest edge, leg. Jacek Kurzawa

Upper Silesia: Gliwice, 05.06-15.06.2003r – trees in lime alley, Zbigniew Chrul leg.

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