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Flight activity of *Anthribus nebulosus* Forster, 1770 (Coleoptera: Anthribidae) and notes to its life history

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ABSTRACT: In the Czech Republic, *A. nebulosus* occurs in coniferous, deciduous as well as in mixed forests, in lowland forests and even on forest-steppe habitats. Larvae occur mainly on *Picea* sp., *Pinus* sp. and *Abies* sp.; adults occur on the same tree species and also on *Larix* sp., *Quercus* sp., *Salix* sp. and *Fagus* sp. Adults overwinter in the bark of several coniferous trees with thicker bark (mainly *Pinus sylvestris* L. and *Larix decidua* Mill.) where they are hidden in cracks. Woodpeckers attack such trees with masses of *A. nebulosus* very intensively. In five localities with Malaise traps in the Nízký Jeseník Hills, the flight activity started at the beginning of May and ended in mid-June with the peak at the end of May and beginning of June in 2005. In 2006, the flight activity started later in mid-May and lasted to the beginning of July but was interrupted by cold and rainy weather. At higher altitudes were beetles sampled only in the first half of June in 2006. The size of males and females is very similar. In total, pronotum width of males varied between 0.85 mm and 2.40 mm, and females between 1.00 mm and 2.30 mm. There is no statistically significant difference between them. The equal sex ratio found in our material could confirm the fact that the flight activity of both sexes is the same.

Keywords: *Anthribus nebulosus*; faunistics; biology; flight activity; body size; Czech Republic

Anthribus nebulosus Forster 1770 (= *Brachytarsus nebulosus* auct.) is an expansive species adaptable to different types of ecosystems (Strejček 1996). Larvae live on branches under scales of cochineals (Sternorrhyncha: Coccinea) of Coccidae (= Lecaniidae), adults can be found on branches and stems of trees and in winter they occur under the bark massively. This species occurs in the whole Palearctic region and it is abundant in the Czech Republic throughout the whole year (Balthasar 1956; Strejček 1990). Because of the fact that both, larvae and adults, are predators (Patočka et al. 1962, 1999), it has been imported to the U.S.A. as a potential pest control method (Kosztarab, Kozar 1983).

In this paper, we analyzed the flight activity of this species by means of the Malaise traps installed in several localities in 2005 and 2006, summarized data concerning occurrence of *A. nebulosus* in the Czech Republic, including tree species, and added some notes to biology of this species.

MATERIAL AND METHODS

The flight activity was studied by the Malaise trap of Townes (1972) type. During years 2005 and 2006, the traps were placed in five localities (Kyjovice: 49°49'30.17''N, 18°3'4.38''E, 390 m a.s.l.; Pustá Polom: 49°51'38.05''N, 18°0'16.99''E, 430 m a.s.l.; Podvihov: 49°51'6.47''N, 17°58'46.72''E, 460 m a.s.l.;

Lesní Albrechtice: 49°48'21.09''N, 17°53'4.78''E, 460 m a.s.l.; Skřipov: 49°48'39.08''N, 17°52'59.02''E, 480 m a.s.l.) in very young spruce forests (10 to 20-year-old) in the Nízký Jeseník Hills. In 2006, one trap was placed in a closed older spruce (*Picea abies* [L.] Karst.) forest (80–110-year-old) at the distance of 50 m apart from the forest edge in the locality Cikháj (49°39'43''N, 15°56'46''E; 780 m a.s.l.) in the Českomoravská vrchovina Hills. The traps were exposed from the beginning of April to the end of October and were emptied every second or third day in May, June and July. Numbers of caught beetles were calculated in ten-day periods.

Faunistic data are presented as follows:

Bohemia[1], Růžová env.[2], Růžovský vrch Hill[3], 5151d[4], 20. VI. 2000[5], *Picea* sp.[6], 1 spec.[7], M. Trýzna leg.[8]

[1]region;

[2]village;

[3]place;

[4]grid mapping square (see Pruner, Míka 1996);

[5]date of collection;

[6]tree species on which beetles were collected;

[7]number of caught specimens;

[8]collector.

All genitalia were dissected to determine both sexes, however the 5th sternite might be also useful as it is depressed in its middle part in male and convex in female (Strejček 1990). Pronotum width was measured in the back part.

Statistical analyses were performed using software Statistica 7.0.

RESULTS AND DISCUSSION

Distribution

Six species of the genus *Anthribus* Geoffroy, 1762 are known from the palearctic region (Rheinheimer 2004). The seventh species is reported from Brazil but it is not congeneric. In the Czech Republic occur two species only, namely *A. fasciatus* (Foerster, 1770) and *A. nebulosus*. The Euroasian *A. nebulosus* is a widespread species; it was recorded from the majority of European countries, North Russia, Near East and from East Palaearctic. In 1970s, it was imported from Hungary to the U.S.A. as a potential pest control method in Virginia (Kosztarab, Kozar 1983). It was recently observed also in Connecticut, Massachusetts and New York as a natural enemy of soft scale insects (Hoebeke, Wheeler 1991; Valentine 1998).

In the Czech Republic represents *A. nebulosus* the most abundant species of the family Anthribidae. It occurs in miscellaneous types of habitats in the whole country. In total, we summarized more than one thousand faunistic data based on our collections as well as other collections (but only those data where the tree species was mentioned are presented below). It occurs at a wide range of altitudes. We observed beetles of this species in the lowest places of the Czech Republic, e.g. 150 m a.s.l. (Bohemia, Hřensko env., 5151a, 13 .V. 2001, *Picea abies*, 3 spec., M. Trýzna leg.) as well as in 1,000 m a.s.l. (Slovakia, Malá Fatra Mts., Vrátna dolina Valley, 6780, 15. VI. 1971, beech-fir forest, 1 spec., J. Strejček leg.).

Survey of collected material

Bohemia, Vysoká nad Labem, 5861, 1. V. 1986, *Picea* sp., 6 spec., M. Mikát leg.;

Bohemia, Růžová env., Růžovský vrch Hill, 5151d, 20. VI. 2000, *Picea* sp., 1 spec., M. Trýzna leg.;

Bohemia, Benešov nad Ploučnicí, 5251, II. 1959, under bark of *Picea abies* L., 10 spec., J. Strejček leg.;

Bohemia, Kyjov, 5052c, 30. VIII. 2004, *Picea abies* L., 1 spec., M. Trýzna leg.;

Moravia, Bzenec, 7069, 11. V. 1986, *Pinus* sp., 1 spec., M. Mikát leg.;

Bohemia, Praha-Komořany, 6052, 23. II. 1952, under bark of *Pinus* sp., 1 spec., M. Reška leg.;

Bohemia, Doubice env., Dravčí skály, 5052c, 8. III. 2004, in bark of *Pinus sylvestris* L., 15 spec., M. Trýzna leg.;

Bohemia, Bohuslavice, 6074d, 14. X. 1996, *Abies* sp., 2 spec., M. Mantič leg.;

Bohemia, Vrané nad Vltavou, 6052c, 3. II. 1952, under bark of *Larix* sp., 1 spec., M. Reška leg.;

Bohemia, Třebeš (nr. Hradec Králové), 5860, 6. IV. 1985, *Salix* sp., 1 spec., M. Mikát leg.;

Bohemia, Děčín, Pastýřská stěna, 5251a, 8. V. 2000, *Quercus robur* L., 1 spec., M. Trýzna leg.;

Moravia, Brno env., dam, 6865, 31. V. 1987, *Quercus* sp., 1 spec., R. Schles leg.;

Bohemia, Stéblová, 5860, 9. V. 1981, *Quercus* sp., 4 spec., M. Mikát leg.;

Bohemia, Telnice, 5249, II. 1950, under bark of *Quercus* sp., 1 spec., J. Strejček leg.;

Bohemia, Růžová env., Růžovský vrch Hill, 5151d, 7. VI. 2005, *Fagus* sp., 2 spec., M. Trýzna leg.

Bionomics

Both species of the genus *Anthribus* occurring in the Czech Republic are predators of scale insects and their eggs. Their larvae feed on scale insects of the family Coccidae. Females of *A. nebulosus* lay in-

dividual eggs (rarely 2–3) under scales of females of *Lecanium* sp. The anthribid larvae feed on the eggs of the scale insects. Larvae pupate in this place and emerged adults bite out through the dorsal parts of hosts' scales (Valentine 1962). The whole development lasts about two months (Silvestri 1919).

Hoffmann (1945) reports the occurrence of *A. nebulosus* with *A. fasciatus* on *Parthenolecanium corni* (Bouché 1844). Blahutiak (1998) reared *A. nebulosus* directly from developed stages of *P. corni*. Masner (personal communication) observed beetles feeding on *Physokermes piceae* (Schrank 1801) in the Krušné hory Mts. (locality Moldava, 5248) in 1959.

In the Czech Republic, *A. nebulosus* occurs in coniferous, deciduous as well as in mixed forests, in lowland forests and even on forest-steppe habitats. We observed it very often on forest edges what was confirmed by Horváth et al. (2002). *A. nebulosus* occurred almost exclusively on the forest edge but it was also present in the meadow close to the studied oak forests.

Larvae occurred mainly on *Picea* sp., *Pinus* sp. and *Abies* sp.; adults were found on the same tree species and further on *Salix* sp., *Fagus* sp., *Quercus* sp. and *Larix* sp. (see above).

In 2002–2003 (–2005), an outbreak of *A. nebulosus* was observed in several parts of the Czech Republic (e.g. in Cikháj). Adults occurred abundantly not only on trees and shrubs but on undergrowth vegetation and plants as well. They overwintered in bark of several coniferous trees with thicker bark (mainly *Pinus sylvestris* L. and *Larix decidua* Mill.) where they were hidden in cracks. We did not observe beetles directly under bark. Woodpeckers attacked trees with masses of *A. nebulosus* very intensively. In winter, they removed a surface layer of the bark so that the stems of trees looked like infested by bark beetles.

Body size, abundance and sex ratio

The body size of males and females is very similar (Fig. 1). In total, pronotum width of males varied between 0.85 mm and 2.40 mm, and of females between 1.00 mm and 2.30 mm in the material from the Nízký Jeseník Hills and Cikháj. There is no statistically significant difference between them (ANOVA, $F = 1.539$, $P > 0.01$). In the past, small beetles that were 1.0–1.5 mm long (body length varies between 1.0 and 4.0 mm) without spots were described as var. *küsteri* Rtt. but this was a result of insufficient feeding during larval development (Strejček 1990). Such small beetles were not found.

The difference in body size between years 2005 and 2006 was found in the material from the Malaise traps in both, males and females (ANOVA, F (2.539) = 10.601, $P < 0.01$). Beetles collected in 2005 were bigger and the abundance was the same in both sexes (Mann-Whitney *U*-test, $P > 0.01$) in 2005 and 2006. The abundance was the highest in locality Skřipov in both years but the supposition of higher density of potential host *Physokermes piceae* (Schrank 1801) was not confirmed by field study. No scale of *P. piceae* was found in any locality either during study periods or in winter. Therefore it is doubtful if the method of Malaise trap could be used as monitoring method.

Sex ratio in our material is equal (portion of males was 0.44) ($\chi^2 = 7.132174$; $P > 0.01$).

Flight activity

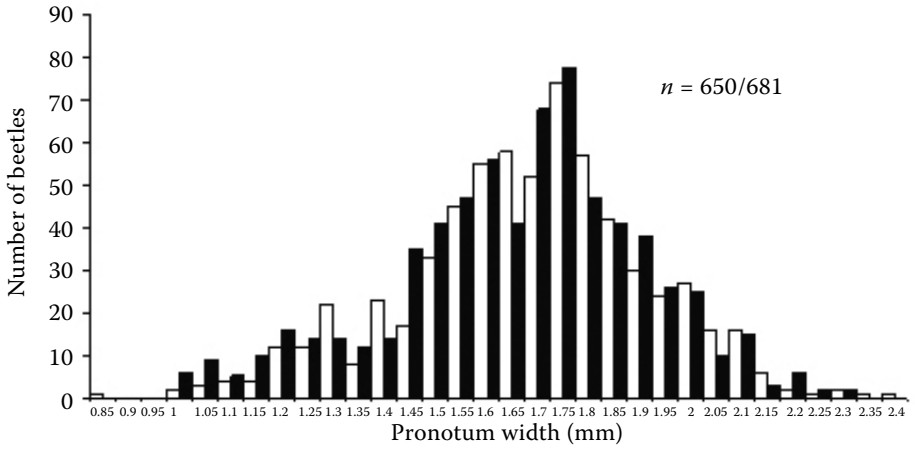

Fig. 1. Pronotum width of *Anthribus nebulosus* males (white column) and females (black column)

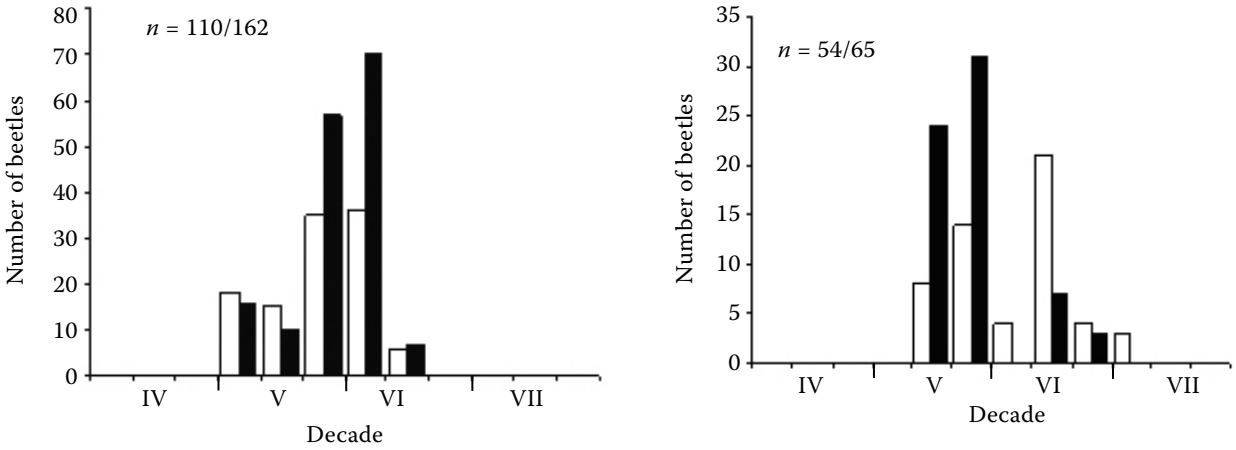

Fig. 2. Flight activity of *Anthribus nebulosus* males (white column) and females (black column) at Skřipov in 2005 (left) and 2006 (right)

Adults of *A. nebulosus* overwinter in bark. This generation leaves this place in spring and flies to new sites. Therefore beetles are collected mainly in May and June (e.g. Cunev 2000). We suppose that beetles caught with the Malaise trap flew in because of their high abundance and the traps being placed in younger spruce forest in longer (several dozen meters) distance from the mature forests where the possibilities of winter shelters were higher. In the Nízký Jeseník Hills, the flight activity started at the beginning of May and ended in mid-June with the peak at the end of May and beginning of June in 2005 (Fig. 2). In 2006, the flight activity started later in mid of May and lasted to the beginning of July but

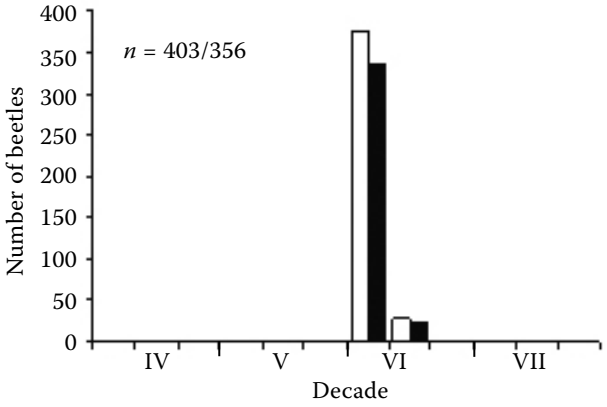

Fig. 3. Flight activity of *Anthribus nebulosus* males (white column) and females (black column) in Cikháj in 2006

was interrupted by cold and rainy weather (Fig. 2). At higher altitudes represented by locality Cikháj, beetles were sampled only in the first half of June in 2006. This period was much shorter (Fig. 3).

The equal sex ratio (see above) found in our material confirm the fact that the flight activity of both sexes is the same.

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Letová aktivita *Anthribus nebulosus* Forster, 1770 (Coleoptera: Anthribidae) a poznámky k jeho biologii

ABSTRAKT: *A. nebulosus* se v České republice vyskytuje v jehličnatých, listnatých a smíšených lesích, v lesích lužních i na lesostepích. Larvy jsme nalézali především na smrku (*Picea* sp.), borovici (*Pinus* sp.) a jedli (*Abies* sp.); dospělce na stejných dřevinách a na modřínu (*Larix* sp.), dubu (*Quercus* sp.), vrbě (*Salix* sp.) a buku (*Fagus* sp.). Brouci přezimují v kůře jehličnatých dřevin se silnější borkou (především *Pinus sylvestris* L. a *Larix decidua* Mill.), kde se ukrývají v puklinách. Hmyzožraví ptáci napadají velmi intenzivně takové stromy, kde brouci masově zimují. Na pěti lokalitách Nízkého Jeseníku začínala v roce 2005 letová aktivita, která byla zjišťována pomocí Malaiseho lapače, na počátku května a končila v polovině června s vrcholem na konci května, resp. na počátku června. V roce 2006 let začal později v polovině května a trval do počátku července, ale letová aktivita byla přerušena deštivým a vlhkým počasím. Ve vyšších polohách kolem 600 m n. m. na lokalitě Cikháj byli brouci odchytáni pouze v první polovině června 2006. Velikost samců i samic je podobná. Šířka štítu samců se pohybovala mezi 0,85 mm a 2,40 mm, samic mezi 1,00 mm a 2,30 mm. Poměr pohlaví je vyrovnaný a může potvrzovat stejné letové schopnosti samců i samic.

Klíčová slova: *Anthribus nebulosus*; faunistika; biologie; letová aktivita; velikost těla; Česká republika

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