

ON THE MASS OCCURRENCE OF TWO RARE SAPROXYLIC BEETLES,
CUCUJUS CINNABERINUS (CUCUJIDAE) AND *DIRCAEA AUSTRALIS*
(MELANDRYIDAE), IN SOUTH MORAVIAN FLOODPLAIN FORESTS

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RÉSUMÉ. — *Sur l'occurrence massive de deux espèces rares de coléoptères saproxyliques* *Cucujus cinnaberinus* (Cucujidae) et *Dircaea australis* (Melandryidae) dans les forêts alluviales du sud de la Moravie. — De 2003 à 2005 les coléoptères saproxyliques ont été étudiés à l'aide de pièges à interception dans trois vieilles formations de forêt pluviale, à dominance de chêne pédonculé et de frêne à feuilles étroites, près de la confluence de la Morava et de la Dyje dans le sud de la Moravie (République Tchèque). Sur chaque site 10 pièges ont été placés durant deux saisons du dernier tiers d'avril ou du début mai jusqu'à la fin septembre ou la mi-octobre. L'analyse des captures est en cours. Les présents résultats s'appuient sur deux saisons à Dlhý hrúd et dans la réserve naturelle nationale de Raňpurk mais sur une seule saison dans la réserve naturelle nationale de Cahnov-Soutok. Le piégeage a donné des nombres remarquablement élevés, respectivement 10 et 63 spécimens, de deux espèces saproxyliques rares et menacées, *Cucujus cinnaberinus* et *Dircea australis*. Les premières données sur *D. australis* dans cette région et donc pour la République Tchèque datent des années 1990. *C. cinnaberinus* a été capturé de la seconde moitié de mai à la première moitié d'août, essentiellement à partir de juillet.

Mots-clés: Coléoptères, bois mort, xylobiotique, pièges à interception, forêt alluviale.

SUMMARY. — From 2003 to 2005 saproxylic beetles were studied by means of flight interception traps in three old growth floodplain forest stands, dominated by pedunculate oak and narrow-leaved ash, near the confluence of the Morava and Dyje rivers in South Moravia (Czech Republic). At each site 10 traps were operated for two seasons from the last third of April or beginning of May till end of September or middle of October. Analysis of the catch is underway; the present results are based on two seasons at the Dlhý hrúd site and the Raňpurk National Nature Reserve, but only on one season in case of Cahnov-Soutok National Nature Reserve. The trapping yielded noteworthy high numbers of two rare and threatened saproxylic species, *Cucujus cinnaberinus* and *Dircea australis*, 10 and 63 specimens, respectively. First records of *D. australis* from this area, and thus from the Czech Republic, are from the 1990s. *C. cinnaberinus* was found exclusively in April and May, whereas *D. australis* was trapped from the second half of May till the first half of August, predominantly from July onwards.

Keywords: Coleoptera, dead wood, xylobiotic, flight interception traps, alluvial forest.

Since 2003, the saproxylic beetle fauna of several floodplain forest old growths along the Lower Dyje and Morava Rivers in South Moravia (Lower Morava Biosphere Reserve, Czech Republic) has been studied by means of a standardized method based on flight interception traps. Analysis of the catch from individual seasons and sites is underway. Two rare species, *Cucujus cinnaberinus* (Scopoli, 1763) (Cucujidae) and *Dircaea australis* Fairmaire, 1865

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(Melandryidae), occurred frequently at three study sites, based on the analysis of the catch from 1 or 2 trapping seasons per site. These results will be discussed in terms of our knowledge about the range, ecology and conservation status of these species.

A high proportion of beetles that depend on dead wood or moribund trees (saproxylic species *sensu* Speight, 1989) are considered rare and threatened. This is also demonstrated by the fact that of eight beetle species given in Annex II of the Berne Convention as well as in Annex IV of the EU Habitat Directive, five are saproxylics; of the 22 beetle species given in Annex II of the EU Habitat Directive, 16 are saproxylics. One of these species is *Cucujus cinnaberinus*, also listed as vulnerable by the IUCN (1996). This beetle of conspicuous appearance but very hidden life has an area of distribution covering Fennoscandia, Eastern Europe (outside Europe into Siberia) and the eastern part of Central Europe, reaching the western border of its range in south-eastern Bavaria (Germany) and the southern one in Bosnia-Herzegovina (Bussler, 2002). *C. cinnaberinus* is considered rare and a primeval forest relict by some authors (e.g. Speight, 1989) while others (Müller *et al.*, 2005) do not consider it dependent on old growths with an uninterrupted history (habitat tradition). New data support the latter view as they show this species to colonize even hybrid poplar plantations with a sufficient amount of dead wood of greater diameters (Bussler, 2002). New data from Bavaria (Bussler, 2002) and the Czech Republic (Chobot, 2006; Mocek, 2007) also indicate that *C. cinnaberinus* is more common and probably also less threatened in Central Europe than formerly assumed, possibly even going through a phase of expansion.

A considerable number of saproxylic beetle species not listed as threatened in international conventions and regulations (sometimes not even in national red lists), have to be considered as similarly or even more dependent on saproxylic habitats scarce due to traditional forest management practices or other human activities. One of these is *Dircaea australis*, a species ranging from France in the west to Latvia and Romania in the east and from southern Sweden in the north to Serbia in the south; its presence in Italy is considered doubtful (Angelini *et al.*, 1995; EUNIS database). According to the EUNIS database, its occurrence in the Czech Republic is doubtful as well. However, several specimens were collected in the south-east of the Czech Republic in the 1990s (Jelínek, 1996; Schlaghamerský, 2000). It is noteworthy that no earlier records are known despite the long tradition and high intensity of entomological research in this part of Central Europe. *D. australis* has been listed as a primeval forest (Urwald) relict in the strict sense for the territory of Germany by Müller *et al.* (2005) and is also considered such in the Czech and Slovak Republics (Jelínek, 1996; Franc, 1994).

MATERIAL AND METHODS

STUDY SITES

Three old growth floodplain forest stands upstream of the confluence of the Dyje and Morava rivers in South Moravia (Czech Republic) were studied: Dlhý hrúd, Ranšpurk National Nature Reserve, and Cahnov-Soutok National Nature Reserve. These sites are embedded in a large complex (4450 ha, see Hrib, 2004) of mostly commercially managed floodplain forests and meadows. Since the mid 1970s most of the area has not been exposed to natural flooding due to river regulation and levee construction (serving as a dry polder), which also led to a drop of the groundwater table. This is probably a major reason for the die-back of many ancient oaks in the forests and meadows; the total drop of the groundwater table is estimated to be *ca* 190 cm (Vrška, 1997). Since the late 1960s most of the area has served as a game reserve and stocking levels of red and fallow deer as well as wild boar have been very high in particular until the 1990s. The forests are generally dominated by pedunculata oak (*Quercus robur* – 49%) and narrow-leaved ash (*Fraxinus angustifolia* – 29%). Mainly in the wetter parts there are poplars (*Populus* spp. – 5%), and some alder (*Alnus glutinosa*) and willow (*Salix* spp.). Hornbeam (*Carpinus betulus* – 4%), lime (*Tilia cordata* – 3%) and field maple (*Acer campestre*) are also well represented (Hrib, 2004). Elm (*Ulmus laevis*, *U. minor*) formerly made up some 30% but was substantially reduced by Dutch elm disease; today only a few elm trees are interspersed in the stands. Scots pine (*Pinus silvestris*) grows on the most elevated areas formed by old aeolian sand dunes. Due to the area's position directly on the Austrian border and thus at the Cold War's Iron Curtain, access was strictly limited to border guards and selected forestry personnel for most of the 20th century's second half. This provided unofficial but effective protection of habitats and wildlife (however, it did not prevent damage due to changes in hydrology and high deer stocking levels). The Dlhý hrúd site (48°42'44"N, 16°54'00"E, 156 m a.s.l.) is a small stand (*ca* 9 ha) dominated by oak, hornbeam, field maple and elm. The average age of the stand is 110 years but there are many ancient trees, mainly oaks, and abundant standing

and fallen dead wood. The stand is situated on the cut bank of the Dyje river (border with Austria), outside of the levee and thus exposed to rather natural and regular flooding, mostly in early spring. It is located outside the game reserve, separated from it by a high wire fence. It was practically not accessed at all for some 40 years preceding 1990, but some wood exploitation has taken place recently. At present it is part of a proposed Special Protection Area under the EU's Natura 2000 scheme. The Ranšpurk site (48°40'40"N, 16°56'55"E, 153 m a.s.l.) is an old growth nature reserve (since 1949) of ca 22 ha, without wood exploitation since 1931 but respected by the forest managers as a "virgin forest" since 1873, when the forests became the property of the house of Liechtenstein (Vrška, 1997). Before that, the stand had served for wood pasturage for centuries, which had a substantial impact on its structure. The stand is on higher ground than its surroundings and its exposure to floods was thus always limited. Flooding ceased after regulation of the Morava river in the 1970s. In the 1990s some controlled flooding of the area has led to a rise of the ground water table and in 1997 the site was flooded during an exceptional summer flood. In 1992 the reserve was fenced in to allow natural regeneration, previously totally suppressed by high deer stocking in the game reserve. Ancient oaks still dominate parts of the reserve but the species is practically missing among the younger trees. The terrain is not completely even and while some alder trees grow in wet depressions, field maple, lime and hornbeam are abundant in the elevated parts. Despite fast decomposition, dead wood volumes are high (144 m³ per ha in 1994). The dynamics of the stand have been intensively studied (cf. Vrška, 1998). The Cahnov-Soutok site (48°39'20"N, 16°56'32"E, 152 m a.s.l.) is an old growth nature reserve (since 1949) of similar history and character as Ranšpurk (Vrška, 1997). The oldest oaks have an age of ca 460 years, many have died and the main storey is now formed by ash. No logging has taken place since the beginning of the 20th century. With 151 m³ per ha (1994) dead wood is even more abundant than at Ranšpurk. Originally there were two reserves some 150 m apart, which were formally united in 1992 (Cahnov – 11.60 ha, Soutok – 1.86 ha, according to their foundation documents, however, the true total area is 17.32 ha, water bodies excluded, see Vrška, 2004). The two parts are separated by a younger, sparse ash stand not belonging to the reserve (but a part of the studied transect was situated here). The Soutok part is situated on an island surrounded by the branches of the small Kyjovka river. Also the Cahnov part is partially hardly accessible due to river branches and an adjacent wet meadow with a large vernal pool. Due to its vicinity to the branches of the small Kyjovka river the site has been exposed to some flooding even after the construction of levees along the major rivers Dyje and Morava. Red deer have been using the reserve as a refuge due to its remote location and a large feeding rack and salt lick facility nearby. In 2004 the Cahnov part of the reserve was fenced off to allow natural regeneration of the stand.

METHODS

At each site 10 flight interception traps were installed in spring along a transect and operated until autumn with catch collection and trap maintenance in equal intervals twice per month. At Dlúhý hrúd, traps were operated from 01.V. to 30.IX.2003 and from 20.IV. to 01.X.2004. At Ranšpurk traps were operated from 20.IV. to 04.X.2004 and from 05.IV. to 16.X.2005. The same applies to Cahnov but only the material from 2004 has been analysed so far.

The traps consisted of two panels of clear, transparent plastic (25 cm wide, 50 cm high) fixed in perpendicular position to each other, thus forming a cross-like structure, covered on the top by a roof and suspended above a funnel (diameter 24 cm) with a wide opening (inner diameter 4.6 cm) connected to a container with non-attractive preservative (2.5% formaldehyde solution). The traps were hung up at ca 1 m height above ground (lower edge of transparent panels) on bamboo poles that were stuck into the ground at random distances (at least 15 m apart) along the transect. The outer surface of the white funnels and collection containers were sprayed with green paint to reduce their visibility and thus the potential attraction of beetles by the white colour as well as the risk of vandalism. The catch was transferred to 70% ethanol and later sorted into higher taxa. Beetles were subsequently mounted and identified (not yet completed for some families).

RESULTS

Two trapping seasons at Dlúhý hrúd and Ranšpurk and one at Cahnov yielded 9 specimens of *Cucujus cinnaberinus*, all collected from mid April to the end of May (Fig. 1). Of those, one specimen was hand-collected on 04.V.05 at Ranšpurk (date of collecting catch of traps for the 2nd half of April period, shown for this period in Fig. 1), all others by flight interception traps. Five specimens were trapped in 2005 at the Dlúhý hrúd site, whereas no specimen was collected here in the preceding year of trapping. The processing of Cahnov material from 2005 has not yet been completed, however, at least one further specimen was collected here in 2005, the total count thus being at least 10 specimens.

The same trapping periods as above yielded a total of 63 specimens of *Dircaea australis*, all trapped between the mid of May and mid August (Fig. 2). While in 2003 the peak in flight activity (as reflected by the trapped material) was in the first half of June (11 specimens, trap operation restricted to Dlúhý hrúd), in 2004 it was high from the beginning of July till mid August at all sites, peaking in the second half of July.

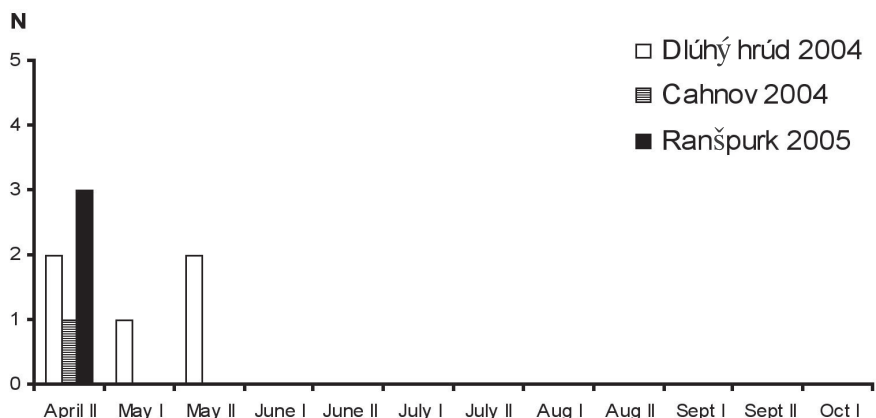


Figure 1. — Flight activity of *Cucujus cinnaberinus* (Coleoptera: Cucujidae) at three study sites in the South Moravian floodplain forests (Czech Republic) during 2003 and 2004, based on 10 flight interception traps per site emptied twice a month (I = 1st half of month, II = 2nd half of month).

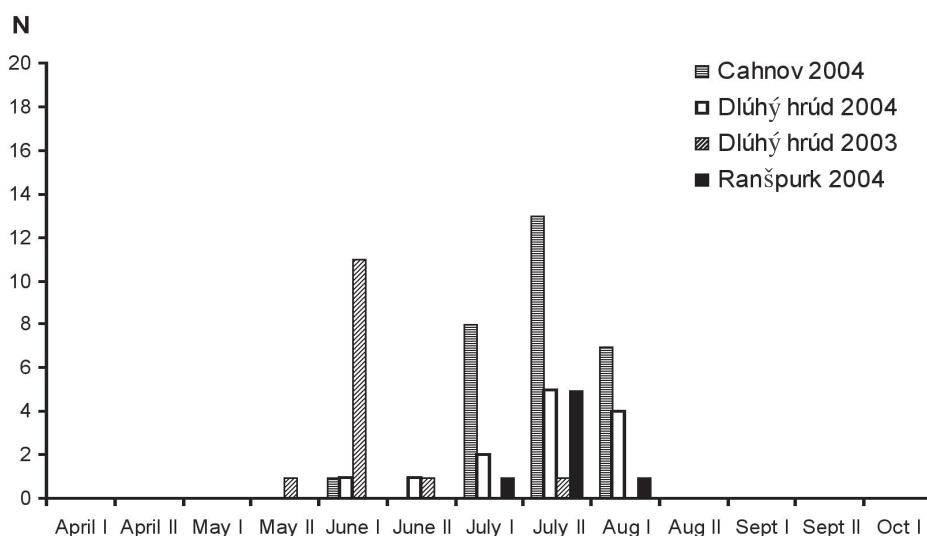


Figure 2. — Flight activity of *Dircea australis* (Coleoptera: Melandryidae) at three study sites in the South Moravian floodplain forests (Czech Republic) during 2003 and 2004, based on 10 flight interception traps per site emptied twice a month (I = 1st half of month, II = 2nd half of month).

DISCUSSION

According to Bussler (2002), the flight and mating activity of *C. cinnaberinus* in Central Europe (based on recent data from Bavaria) takes place from April to June, most of it from mid April to mid June in lowlands and from May to mid June at sub-montane localities. This is in agreement with our own observations from the lowlands of South Moravia. Our data indicate that some flight activity might have occurred even earlier in April (before we installed our traps – in several cases we had to postpone the date of trap installation till the second half of April

or beginning of May because of the inundation of the study sites). No specimens were trapped in June; possibly because our study area has a warmer, more continental climate compared to the Bavarian localities. Although our study sites were situated in a well-documented hot-spot of occurrence of *C. cinnaberinus* in the Czech Republic (Chobot, 2006), the number of specimens collected during the present study has to be considered high. Three possible reasons for this are (1) the use of flight interception traps as a method almost not previously used in this area, (2) an increase in abundance of *C. cinnaberinus* in the studied years compared to the previous period, and (3) the selection of study sites. The first author has used classic window traps (1 m x 1 m pane, one trap per site, 1 season per site) at three sites in the study area (including one identical site, i.e. Dlouhý hrád, then erroneously called Držkův hrád) in 1997 and 1998 (Schlaghamerský, 2000). No *C. cinnaberinus* individual was trapped at that time (the additional use of emergence traps with enclosed oak logs yielded not a single individual, and hand-collecting only one dead specimen found under the bark of a fallen poplar at a site not included in the present study). However, a higher number of smaller traps, as used in the present study, increases the probability of intercepting a rare species, compared to the operation of a single, larger window trap. The second possible reason, that is an increase in abundance, is supported by recent data from Bavaria (Bussler, 2002) as well as from the Czech Republic, where the species has been observed more frequently in the South Moravian floodplains as well as in other localities, including some where the species was observed for the first time (Chobot, 2006, pers. comm.; Mocek, 2007). Also, the first author has hand-collected another specimen on 13.V.2005 in another locality in the Dyje floodplain (Lednice, “U loveckého zámečku”). Also the third possible reason, the fact that the three most ancient forest stands in the whole area, with limited access to other entomologists, were studied, might have contributed to the rather high number.

Thus we are not able to reject any of these possible explanations and assume that all of them contributed to the rather high number of specimens collected in the present study.

Regarding *D. australis*, the present data (collected almost 10 years after the first record from the country) show that the species is well established in the southern-most tip of the Czech Republic. The extraordinary high number of specimens collected becomes apparent when compared with the four previous records from the Czech Republic (see above) but also with the fact that up to 1994 the total number of specimens collected in neighbouring Slovakia was 17 (Franc, 1994; we are not aware of further, more recent accounts). All the three reasons for the lack of data from former times and for the mass occurrence of *C. cinnaberinus* observed during our study apply also for *D. australis*. Previous trapping by window traps (see above) had yielded two *D. australis* specimens (Schlaghamerský, 2000; the collection site reported as “Confluence”, in Czech “Soutok” is close to the actual confluence of the Morava and Dyje rivers and not identical with the Soutok part of the Cahnov-Soutok National Nature Reserve). Thus flight interception traps have yielded almost all specimens ever collected in the Czech Republic. *D. australis* is generally a rather thermophilous species, so that the warmer climate of the last decades might have contributed to its spread to South Moravia. However, we consider this rather improbable as it has been known from montane localities in Slovakia (Franc, 2000) and also in southern Sweden (Lundberg, 1993). Lundberg (1993) reported on its increased abundance in southern Sweden in the 1960s as a consequence of the die-back of trees such as birch and aspen, killed by herbicides as part of forest management. This observation indicates that the species does not have to be as dependent on old growths as generally assumed (see above). It also suggests that the present mass-occurrence observed in the South Moravian floodplain forests might have a reason in the increased amount of suitable substrate for the development of its larvae. However, the data available do not allow to correlate the species' abundance with factors such as amount of dead wood or tree species composition. In particular, we miss data on the abundance of *D. australis* in previous years based on the same collecting method. All three above-mentioned potential reasons might have contributed to the high numbers observed in the present study. What might have been particularly important is the use of flight interception traps with a trapping season extending over the whole summer: most specimens were trapped in mid-summer, that is at a time when the activity of many other beetles (and coleopterists) is already low. Thus the species might have passed unrecorded in the area for a long time.

The method employed in the present study seems suitable for revealing the presence of such a rare species of limited flight period and hidden life as *C. cinnaberinus* and could be used for the monitoring of its populations. The method's big advantage is its non-invasive character, as no micro-habitat is disturbed or destroyed for instance by bark peeling. However, if the occurrence of *C. cinnaberinus* at a given site is proven, or if only this or a small set of species with defined biology are to be monitored, the targeted search for the larvae by bark peeling might be a more efficient method (Bussler, 2002). The case of *D. australis* shows the particular value of the method, designed for the study of the entire saproxylic assemblage (except species lacking the ability of flight or of very low flight activity, which are of course particularly important from the conservation point of view due to their low ability to colonize new patches of suitable habitat in a fragmented landscape). As we know very little about the biology of this species, flight interception traps seem the best method to reveal its presence and information about its abundance at a given locality.

CONCLUSIONS

The present study provides valuable data on the abundance of rare saproxylic beetles in South Moravian old growth floodplain forests. *C. cinnaberinus* and *D. australis*, both considered very rare all over Europe, have been shown to live in rather strong populations at the study sites. In the case of *D. australis* this is rather surprising, as it had been recorded in the area for the first time only in the 1990s. The reasons for the observed mass-occurrence of both species are unclear and several explanations can be given, possibly all true to some extent. In the case of *C. cinnaberinus* it seems probable that the abundance and range of the species has been really increasing in recent years. In the case of *D. australis* the possibility that a strong (probably fluctuating) population has been living in the study area for a long period cannot be excluded. The fact that it was not recorded in the area before 1996 might be connected with its late timing of flight activity in terms of the season and with the restricted access to the area before 1990.

The present data, collected by an easily reproduced method, are well suited to serve as a baseline for further monitoring of these populations. Our results support the view that sets of flight interception traps are very suitable for monitoring purposes, particularly in reserves, where the destruction of suitable microhabitats should be limited to a minimum even in the case of scientific studies.

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