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Distribution and ecology of *Cartodere bifasciata* and
C. nodifer in The Netherlands (Coleoptera:
Corticariidae)

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Abstract: The Australasian *Cartodere nodifer* and *C. bifasciata* are nowadays widespread throughout The Netherlands after their first discovery in 1865 and 1969, respectively. The extension of the distribution area of *C. bifasciata* during the last three decades of the 20th century is presented in detail. Both species, often found under similar conditions, invaded successfully natural habitats to become an abundant element of the Dutch fauna.

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Introduction

In 1995 the Section Everts of the Netherlands Entomological Society started a survey on the distribution of ten species of beetles. In this article the results on two of these species, *Cartodere bifasciata* (Reitter) and *C. nodifer* (Westwood), are presented. *Cartodere bifasciata* was chosen because it represents an interesting case of an introduced species that in less than two decades colonised the whole of The Netherlands. In Europe, this Australasian species was first reported from Great Britain (Allen, 1951). In The Netherlands it was first recognised in 1969 (Berger & Poot, 1970; Van Heijnsbergen, 1970).

Data on the widespread *C. nodifer* were collected as a reference: both species are closely related, of the same size, can be found under similar conditions and are, nowadays, widespread throughout the country.

Material

Material in the collections of National Museum of Natural History 'Naturalis', Leiden (RMNH), the Zoological Museum, Amsterdam (ZMAN) and the Department of Entomology of Wageningen University (Wageningen)

was studied. In addition data were obtained from members of the Section Everts. A total of 2,125 specimens was studied. For ecological and phenological analyses data derived from a survey of fruit orchards was omitted (385 specimens).

European distribution

Cartodere bifasciata originates from Australia and was described in 1877 from imported Australian tobacco. After some accidental imports in Germany, Belgium and France (Dajoz, 1960; Reitter, 1877), introduction in England resulted in the successful establishment of a wild population on the Northern Hemisphere. The first British specimens of *C. bifasciata* were collected in 1949 in the northeast of Surrey (Allen, 1951). The next few decades the species rapidly spread over southern Britain, where it became almost ubiquitous in the early seventies (Hammond, 1974). At the same time *C. bifasciata* reached the European mainland. In September 1969 it was discovered at several localities in The Netherlands: Naarden, 6-10.ix.1969 (Van Heijnsbergen, 1970), Rozenburg, ix.1969, and Wouw, ix.1969 (Berger & Poot, 1970). In the examined collections older material of *C. bifasciata*

Table 1. Ten earliest localities of *Cartodere bifasciata* in The Netherlands.

co-ordinates	locality	date	collector	source
135-475	Naarden	6.ix.1969	S. van Heijnsbergen	ZMAN; Heijnsbergen, 1970
		18.x.1969	S. van Heijnsbergen	ZMAN
		6.xi.1969	S. van Heijnsbergen	ZMAN
075-435	Rozenburg	ix.1969		Berger & Poot, 1970
		20.x.1969	H.J. van der Krift	RMNH
085-390	Wouw	ix.1969		Berger & Poot, 1970
075-390	Bergen op Zoom	12.iv.1970	H.J. van der Krift	RMNH
		17.iii.1972	H.J. van der Krift	RMNH
060-430	Rockanje	4.vii.1970	Ent. exc. Voorne	ZMAN
065-435	Oostvoorne	24.vi.1971	Ent. exc. Voorne	ZMAN
		23.iv.1974	Th. Heijerman	RMNH
090-460	Leiden	4.v.1974	A. van Assen	RMNH
115-390	Chaam	22.ix.1974	H.J. van der Krift	RMNH
100-410	Moerdijk	31.iii.1975	C.J.M. Berger	RMNH
055-405	Ouwkerk	20.iv.1975	H.J. van der Krift	RMNH

was absent. In 1971 *C. bifasciata* was reported from Belgium: Vilvoorde, 5.vi.1971 (Smee-kens, 1971). Only a few years later *C. bifasciata* was collected in Germany, close to the Dutch border: Norf bei Neuss, xii.1975 (Koch, 1978; Lucht, 1976).

Nowadays *Cartodere bifasciata* is a wide-spread and common species both in The Netherlands (Sterrenburg, 1989) and in Belgium (Boosten, 1984; Segers, 1983; Verbeelen, 1979). In Germany it is distributed throughout the country, however, it has not been reported from most of the eastern districts (Köhler & Klausnitzer, 1998). In Denmark, where it was first reported in 1979 by Bangsholt (1981), it is still not very common and only known from four out of the eleven districts (Hansen, 1996). For Fennoscandia, Lundberg (1995) gives only a natural occurrence in Skåne, the southernmost province of Sweden. The first record from the north of France, in the region of Paris, dates from 1990 (Dajoz, 1993). In Austria *Cartodere bifasciata* was discovered in 1991 (Brandstetter & Kapp, 1994).

According to recent regional catalogues *C. bifasciata* did not yet reach the Baltic states (Lundberg, 1995; Telnov et al., 1997), Belarus (Alexandrovitch et al., 1996), Poland (Burakowski et al., 1986), the Czech and Slovak Republics (Jelínek, 1993) or Italy (Audisio et al., 1995).

Cartodere nodifer, used as a reference species in this study, has a similar immigrant

history. This species too originates from Australia. After transportation to the British Isles by man in the 19th century (1839), it crossed the Channel to France and was recorded from Rouen in 1857 and from Gascogne in 1877. Germany was reached around 1870 (Hammond, 1974; Horion, 1961). This is in agreement with the oldest known Dutch specimen which dates from April 1865 (Amsterdam, J. Kinker; ZMAN). The first record of *C. nodifer* in the Dutch literature probably refers to the same specimen: 'In April aan den oever van den Schinkel, Kink.' [In April on the banks of the Schinkel, Kinker] (Snellen van Vollenhoven, 1870). In an earlier catalogue (Snellen van Vollenhoven, 1858) the species was still absent. To date *Cartodere nodifer* is ubiquitous throughout Europe.

Colonisation of The Netherlands

Based on the available material a reconstruction of the recent expansion of *Cartodere bifasciata* in The Netherlands was attempted. Table 1 summarises the ten earliest Dutch localities based on both literature and collection material. These are confined to the southwest of the country in the provinces of Zeeland, Zuid-Holland, the western part of Noord-Brabant and the south of Noord-Holland. During the first ten years of its expansion, between 1969 and 1979, the island of Terschelling (Friesland) and Echt (Limburg) are



Fig. 1-6. Distribution of *Cartodere bifasciata* (1, 3, 5) and *C. nodifer* (2, 4, 6) in 10 × 10 km squares (Dutch national grid) during three periods: 1969-1978 (1, 2), 1979-1988 (3, 4) and 1989-1998 (5, 6).



Fig. 7. Distribution of *Cartodere bifasciata* (closed circles) and *C. nodifer* (open circles) in The Netherlands.

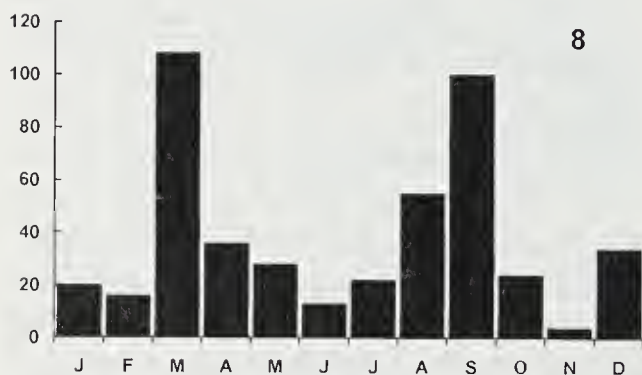


Fig. 8-9. Phenology of *Cartodere bifasciata* (8) en *C. nodifer* (9). Indicated is the number of specimens collected in each month.

reached (fig. 1). In that period the species was still absent from large parts of the country in the north and east. The distribution of *C. nodifer* in the same period (fig. 2) shows that collecting activities were certainly not limited to the southwest. Especially in the provinces Noord-Brabant and Limburg keen collectors were present.

The next ten years *Cartodere bifasciata* is extending its range and reaches the Veluwe (fig. 3-4). It was, however, still not observed in the northern provinces: mainland Friesland, Groningen, Drenthe and Overijssel. Finally in the last decade it succeeded in colonising the whole of the country, although records from the provinces of Groningen and Drenthe are not yet available (fig. 5-7). Recent extensive collecting by coleopterists in the Lauwersmeer area (Groningen) did not reveal this species (Cuppen et al., 1999), indicating that it is by no means common in that part of the country.

Most probably The Netherlands were colonised by wind-blown British specimens that succeeded in crossing the North Sea. A repeated introduction from Australia by man seems less probable, as *C. bifasciata* arrived in The Netherlands not before high population densities in England could serve as an unlimited source for dispersal. Moreover, the invasion started in the part of the country that is closest to Britain. Remarkable is the presence of large waterbodies, either fresh or salt, close to many of the early localities suggesting anemohydrochoric processes as a potential in-

Table 2. Abundance of *Cartodere*-species in several micro-habitats. Presented is the number of specimens and, between brackets, the relative abundance as percentage.

	<i>C. bifasciata</i>		<i>C. nodifer</i>	
soil	113	(36)	61	(16)
mosses	4	(1)	1	(0)
grass/herbage	36	(11)	29	(8)
shrubs/trees	5	(2)	5	(1)
fungi	7	(2)	33	(9)
wood/bark	12	(4)	40	(10)
vegetable matter	111	(35)	74	(19)
dung	18	(6)	46	(12)
carrion	5	(2)	74	(19)
nests	5	(2)	22	(6)
	316	(100)	385	(100)

Table 3. Abundance of *Cartodere*-species in several biotopes (as table 2).

	<i>C. bifasciata</i>		<i>C. nodifer</i>	
urban area	22	(9)	39	(14)
arable land	2	(1)	2	(1)
waste land	39	(15)	47	(16)
grassland	81	(32)	12	(4)
shrubland	14	(6)	8	(3)
hedgerows	11	(4)	17	(6)
woodland	55	(22)	155	(54)
heathland/moors	2	(1)	2	(1)
bare ground	28	(11)	6	(2)
	254	(100)	288	(100)

vasion strategy (Palmén, 1944).

It seems plausible that several independent colonisation events are involved. Especially the early, isolated appearance on the island of Terschelling points in this direction as well as the simultaneous discovery at three widely separated localities (table 1). A single colonisation event combined with a late discovery, masking an early expansion phase of *C. bifasciata*, seems not probable.

Bionomics

Larvae and adults of the family Corticariidae (formerly Lathridiidae) are commonly considered as mould-feeders. Both *Cartodere*-species are no exceptions, and are often collected in mouldy and humid habitats. Their dependence on mould is also reflected in a preference for decaying organic material. Especially for *C. nodifer* this is the case as most specimens were found in association with either carrion, decaying vegetable matter, dung, fungi or dead wood and bark, and only 16 % was collected on the soil (table 2). In *C. bifasciata* however, the largest fraction of specimens (36 %) was soil-dwelling, clearly indicating a difference in ecological preferences between both species. This is also indicated by *C. nodifer* showing a strong preference for wooded areas (54 %) as compared to *C. bifasciata* (22 %; table 3). The ability of *C. bifasciata* and *C. nodifer* to successfully invade into our natural habitats and become a truly abundant element of the fauna is remark-

able. In contrast to many other introduced Coleoptera they are not restricted to man-made micro-habitats as compost, manure heaps, hay stacks or stables and buildings.

Both *Cartodere*-species can be collected all the year round. Based on the number of specimens collected, *Cartodere bifasciata* is most frequent in March and September. During the summer it is less abundant (fig. 8). *Cartodere nodifer* is most encountered from early spring till the end of the summer (fig. 9). Possibly the latter species is equally abundant during the whole year and its apparent scarceness during the winter months only reflects low collecting activity during that period.

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