The genus *Stenostola* Dejean, 1835 (Coleoptera, Cerambycidae) in Norway, with a review of the biology and the distribution in Fennoscandia

TORSTEIN KVAMME & HENRIK WALLIN


Both *Stenostola ferrea* (Schrank, 1776) and *S. dubia* (Laicharting, 1784) are verified recorded in Norway. *S. dubia* is locally common and distributed in the coastal and lowland areas of South Norway as far north as Midtre Gauldal in Sør-Trøndelag County. *S. ferrea* is regarded as a rare species with a limited distribution in southernmost Norway. All old examined specimens of *S. ferrea* were misidentified specimens of *S. dubia*. The distribution is probably limited by unfavourable climatic conditions, not the distribution of the main host tree *Tilia cordata*. We consider the population of *S. ferrea* in Norway as a possible relict. Together with information from a literature review, the present knowledge on both species is discussed in a historical context and European context. It is evident that information on the biology, as well as choice of host trees, often contains contradicting and confusing information due to misidentifications of the beetles. *S. ferrea*’s use of host trees other than *Tilia* spp. needs to be confirmed. The differences in the biology of the two species are not fully understood. We have found no documentation or indication that there has been a decline or an increase in the populations of the two *Stenostola* species in Norway. The availability of suitable host tree substrate, quality of habitats and fragmentation has according to our knowledge not been altered. This combined with the uncertainty and unanswered questions about distribution and biology lead to the conclusion that *S. ferrea* should remain Data Deficient (DD) in the Norwegian red list instead of Vulnerable (VU) until new data show otherwise.

Key words: *Stenostola ferrea*, *S. dubia*, Cerambycidae, Coleoptera, Norway, host trees, distribution, biology, red list category.

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**Introduction**

Worldwide, 12 species of the genus *Stenostola* Dejean, 1835, are known (Bily & Mehl 1989). Seven species and two subspecies of the genus are known from the Palaeartic Region (Löbl & Smetana 2010). *S. ferrea* (Schrank, 1776) is divided into two subspecies: *S. ferrea ferrea* (Schrank, 1776) is widely distributed in Europe and Turkey whilst *S. ferrea maculipennis* Holzschuh, 1982, is only known from the Russian South European Territory. Traditionally both *S. dubia* (Laicharting, 1784) and *S. ferrea* have been listed as recorded from the Nordic countries (Lindroth 1960, Lundberg 1995, Hansen 1996, Silfverberg 2004). Up to 1948 only *S. ferrea* was considered Swedish, and *S. dubia* was published from Sweden for the first time by Tjeder (1948) (see
Klefbeck 1962). However, in many collections, *Stenostola* specimens have been misidentified. Wallin et al. (2005) revised the Swedish material and gave an account of the historical use of names. Furthermore, they discussed the validity of the taxonomical characters. Their conclusion after examination of the Swedish specimens is that all the specimens of *S. ferrea* in Sweden are truly *S. dubia*. Consequently, *S. ferrea* has been deleted from the Swedish list. Wallin et al. (2005) did not examine Norwegian specimens, thus leaving the question of the occurrence of *S. ferrea* in Norway unanswered.

### Material and methods

Unless otherwise stated, the specimens have been examined and identified by the authors according to the characters described by Wallin et al. (2005). Information from collectors has only been included if the specimens have been revised by the characters given by Wallin et al. (2005).

Abbreviations used; FØD = Frode Ødegaard, Trondheim, NHMO = Natural History Museum, University of Oslo, NINA = The Norwegian Institute for Nature Research, OHA = Oddvar Hanssen, Trondheim, SLI = Sindre Ligaard, Vestby, TM = Tromsø Museum

The records mentioned in the literature have been listed only when reference specimens have been revised. Unverified records from literature have consequently been omitted due to the many misidentifications (eg. Lysholm 1937, Strand 1946, 1970, 1977).

We searched for information on biology and host trees in literature from the Nordic countries as well as continental publications. However, the total reference list is not complete and should be regarded as a selection due to language problems etc.

The handwritten notes left by Andreas Strand have been studied. These notes contain a list of records and collectors, and constitute the basis
FIGURE 2. *Stenostola dubia* (Laicharting, 1784) from mass occurrence at Borre, Eikenes, west of Borrevann (EIS 19) 1979.06.20. Photo: Karsten Sund.

for the Norwegian part of the beetle catalogue (Lindroth 1960, Silfverberg 1979). Information such as who identified the material was only occasionally recorded by Strand. The collector’s identity may be deducted, based on these notes, if it is not mentioned on the specimen’s label. When the collection date is unknown, the year of death of the collector is used as an indication, eg. Ullmann before 1923.

Results

**Stenostola ferrea** (*Schrank, 1776*) (Fig. 1)


**Stenostola dubia** (*Laicharting, 1784*) (Fig. 2)

Material: Ø Moss (EIS 19) 13 May 1988, 1 ex., leg. B. A. Sagvolden, coll. NHMO; Råde: Tasken (EIS 19) 12 June 1988, 1 ex., leg./coll. OHA; AK Bærum: Fornebu (EIS 28) 9 July 1998, 2 exx., leg./det./coll. FØD; Frogn: Håøya (EIS 28) 29 May 1988, 1 ex., leg. S. O. Hansen, revised by /coll. FØD; Oppegård: Bårud (EIS 28) 6 June 1875, 1 ex., leg. Sparre Schneider [revised by A. Strand], coll. NHMO; Oslo: Hvervenbukta 20 March 1960, 1 ex. [reared from *Tilia cordata* 5 April 1960, previously identified as *S. ferrea*], leg. A. Bakke, coll. NHMO; Oslo [Kristiania]: Toyen? (EIS 28) 1870s, 1 ex., leg. Münster [old label
with *S. ferrea*, but later revised by A. Strand to *S. dubia*, coll. NHMO; Oslo [Kristiania] (EIS 28) before 1939, 1 ex., leg. Warloe [later revised by A. Strand], coll. NHMO; Oslo? [Kristiania?] (EIS 28) before 1884, 2 exx., leg. Esmark [later revised by A. Strand], coll. NHMO; Oslo: Bygdøy, Bukten (EIS 28) medio June 1931, 1 ex., leg. Münster, coll. NHMO; Oslo: Aker (EIS 28) before 1918, 1 ex., leg. W. M. Schøyen [later revised by A. Strand], coll. NHMO; Nesodden (EIS 28) 3 June 1979, 1 ex., leg. T. Kavmme, coll. NHMO; BØ Ringerike (EIS 36) before 1939, 1 ex., leg. Warloe [later revised by A. Strand], coll. NHMO; VE Borre: Eikenes, west of Borrevann (EIS 19) 20 June 1979, >14 exx. [mass occurrence; hatched from, sitting on and flying around *Fraxinus excelsior* trees], leg. T. Kavmme, coll. NHMO; Tjøme: Mostranda (EIS 19) 14 June 1986, 1 ex., leg. S. O. Hansen, revised by/coll. OHA; Grimstad (EIS 6) 19 May-27 June 1983, 1 ex. [from trap], leg. T. Kavmme, coll. NHMO; Kristiansand: Stangenes (EIS 2) 23 June 1983, 1 ex. [sampled from the same firewood store as *S. ferrea*], leg. T. Kavmme, coll. NHMO; Nedenes (EIS 6) before 1884, 6 exx., leg. Aall [5 exx. later revised by A. Strand], coll. NHMO; Risør (EIS 11) 12 June 1910, 1 ex., leg. Warloe [later revised by A. Strand], coll. NHMO; VAY Kristiansand: Nedre Timenes (EIS 2) 7 June 2004, 1 ex., leg. K. Berggren, coll. NHMO; Kristiansand: Nedre Timenes (EIS 2) 2 June 2009, 1 ex., leg. K. Berggren, det./coll. OHA; Kristiansand: Stangenes (EIS 2) 23 June 1983, 1 ex. + 27 June 1983, 1 ex. + 29 June 1983, 1 ex., leg. S. Svendsen, coll. NHMO; Lyngdal (EIS 1) before 1954, 2 exx., leg. F. V. Holmboe [the specimens were originally identified as *S. ferrea*] [from coll. F. Jensen], coll. NHMO; SFI Sogndal: Fatlaberget (EIS 50) 3 June-10 July 1989, 1 ex. [trap], leg. coll. OHA; Stryn: Lindvik (EIS 68) 29 May-29 June 1988, 1 ex. [trap], leg./coll. OHA; MRI Sunndal: Oppdølstranda (EIS 85) 10 June-9 July 1983, 1 ex. [trap] + 1-15 June 1988, 1 ex. [trap] + 30 June-24 July 1988, 1 ex. [trap] + 11 June-15 May 2006, 1 ex. [light trap], leg. K. Berggren & R. Voith, coll. NHMO; Tjøme: Mostranda (EIS 19) 14 June 1986, 1 ex., leg. S. O. Hansen, revised by/coll. FØD; Tjøme: Ormelet (EIS 19) 7 April 1985, 1 ex., leg. A. Fjellberg, coll. TM; Tjøme: Tjøme (EIS 19) 9 June 1986, 1 ex., leg. S. Grieg [ex coll. A. Vik], coll. NHMO; Tjøme: Tjøme (EIS 19) 9 June 1986, 3 exx., leg./coll. SLI; Tøy Kragerø (EIS 11) before 1923, 1 ex., leg. Ullmann [revised by Münster] [old label with *S. ferrea*], coll. NHMO; Kragerø (EIS 11) before 1923, 2 exx., leg. Ullmann [later revised by A. Strand], coll. NHMO; AAY Tvedestrand: Borøya (EIS 6) 19 June 1940, 1 ex., leg. J. Kielland, coll. NHMO; Arendal: Tromøya, Gjerstad (EIS 6) 22 May 1994, 1 ex., leg. A. Bakke, coll. NHMO; Birkenes: Birkeland (EIS 6) 9 July 2000, 1 ex. [from trap], leg. S. Svendsen, coll. NHMO; Froland: Ripåsen (EIS 6) (no date), 1 ex., leg. S. O. Hansen, revised by/coll. FØD; Grimstad: Omre (EIS 6) 11 June 1978, 5 exx. [sweepnet from broadleaved trees], leg. A. Bakke & T. Kavmme, coll. NHMO; Grimstad (EIS 6) 19 May 1988, 1 ex., leg. B. A. Sagvolden, coll. NHMO; Nedenes (EIS 6) before 1884, 6 exx., leg. Aall [5 exx. later revised by A. Strand], coll. NHMO; Risør (EIS 11) 12 June 1910, 1 ex., leg. L. O. Hansen, revised by/coll. FØD; Grimstad: Omre (EIS 6) 11 June 1978, 5 exx. [sweepnet from broadleaved trees], leg. A. Bakke & T. Kavmme, coll. NHMO; Grimstad (EIS 6) 19 May 1988, 1 ex., leg. B. A. Sagvolden, coll. NHMO; Nedenes (EIS 6) before 1884, 6 exx., leg. Aall [5 exx. later revised by A. Strand], coll. NHMO; Risør (EIS 11) 12 June 1910, 1 ex., leg. L. O. Hansen, revised by/coll. FØD; Grimstad: Omre (EIS 6) 11 June 1978, 5 exx. [sweepnet from broadleaved trees], leg. A. Bakke & T. Kavmme, coll. NHMO.
Discussion

The results of the revision of the Norwegian specimens are discussed together with the information from the literature studies. For practical reasons the information is organized as subjects and the present knowledge can be seen in a historical as well as a wider geographical context than Norway.

Distribution. The examination of specimens in the Norwegian collections shows that *S. ferrea* has been found only in Aust-Agder and Vest-Agder counties, at 4 localities totally as listed above.

The handwritten list by Andreas Strand includes four records of *S. ferrea*: AK: Oslo, Hvervenbukta (EIS 28) (Leg. Alf Bakke); TEY: Porsgrunn (EIS 18) (Leg. Gasmann according to Emark); AAY: Risør (EIS 6) (Leg. Helliesen) and VAY: Lyngdal (EIS 1) (Leg. Holmboe). The specimens from Oslo, Hvervenbukta and Lyngdal have been revised and are all *S. dubia*. The rest of the specimens have not been found. Other old records of *S. ferrea* mentioned in literature should be deleted until specimens can be examined and the identification confirmed.

The records of *S. ferrea* are all from the nemoral and boreonemoral zones (Fig. 4), which constitute a small area in the southernmost part of Norway (Nordiska Ministerrådet 1984, Moen 1998). It is reasonable to believe that *S. ferrea* is locally overlooked in Norway due to the former identification problems and lack of sampling focus.

The specimen examination confirms that *S. dubia* is distributed along the coast and lowland areas of south and western Norway, northwards to STI: Midtre Gauldal, Mosand (EIS 87) (Fig. 3). An old record from STI: Støren near Trondheim (EIS 92) (Lysholm 1937, see Lindroth 1960) is probably correct, but we have not seen the specimen(s). The northernmost Norwegian record ever mentioned in literature is from NSI: Saltdal (EIS 127) (Strand 1946, see also Lindroth 1960). The record was done by A. O. C. Hagemann (1856-1907). He lived and worked as a forest manager in Saltdal from 1879 to 1887. He was a skilled entomologist and published the first Norwegian guidebook on Norwegian forest insects in 1891. However, Hagemann (1891) does not mention *S. dubia* in his book. We have not seen his specimen(s), but we believe the identification to genus is correct and that *S. dubia* is the only possible species in the area. *S. dubia* might occur in the area because of the mild climatic conditions due to the Golf Stream and also the Swedish northernmost records considered (Lindhe et al. 2010). This occurrence still needs to be confirmed by new samples, since no reference specimen has been found. The conclusion so far is that the record of *S. dubia* from STI: Midtre Gauldal, Mosand, is the northernmost verified record in Norway.

In Sweden *S. dubia* (called *S. ferrea* in older literature) is reported as far north as Ångermanland, Medelpad and Hålsingland provinces. An old and doubtful record was reported from Lappland province by Zetterstedt (Klefbeck 1924, see also Grill 1896, Hellén et al. 1939, Palm 1951). The 1939 catalogue (Hellén et al. 1939) was the basis for the Swedish part of the 1960 catalogue (Lindroth et al. 1960). All these northern records were omitted in the 1960 catalogue, based on Klefbeck’s notes in his personal copy of the 1939 catalogue (Stig Lundberg pers. com.). In the later catalogues (Lundberg 1986, 1995), a record of *S. dubia* from Medelpad province was included by mistake (Stig Lundberg pers. com.). Lindhe et al. (2010) list records from Medelpad, Ångermanland, Lule Lappmark and Torne Lappmark provinces (http://www.sef.nu/et/Database_ET_2011_4.xls). Neither the records from Ångermanland and Torne Lappmark nor the old records by Zetterstedt are marked on the maps. The two enigmatic records from Jokkmokk, 1906 and 1983, represent the northernmost records of *S. dubia*.

The nearest localities of *S. ferrea* are in Denmark and most records old. However, the species has been found as late as 1997 at Lolland, which indicates that it still might exist in Denmark (Wallin et al. 2005, Thomsen 2007).
FIGURE 3-4. Red circles are based on revised specimens. The blue triangle indicates the record of A. O. C. Hagemann from Saltdal in Nordland County (Strand 1946). 3. The records of *Stenostola dubia* (Laicharting, 1784). 4. The records of *Stenostola ferrea* (Schrank, 1776).
The distribution pattern and the biological information available indicate that *S. ferrea* is a more heat demanding species than *S. dubia*. *S. ferrea* has a more southern oriented distribution, reaching as far south as Turkey (Löbl & Smetana 2010). The distribution of the main host tree, *Tilia cordata*, is much wider than the known distribution of the beetle. Thus we conclude that temperature is a more limiting factor than the availability of host trees.

**The host trees of *S. dubia* and *S. ferrea***. In the Palaearctic beetle catalogue (Löbl & Smetana 2010), the countries in which *S. dubia* and *S. ferrea* have been found are listed. Finland is by mistake still listed under *S. ferrea*, although it has been deleted from the Finnish list (Clayhills 2002, Heliövaara et al. 2004, Wallin et al. 2005). Consequently all the information on host trees in Finland has been transferred to *S. dubia*. The same situation applies to Sweden, where *S. ferrea* also has been deleted from the list (Wallin et al. 2005). In Denmark the two species are said to have a similar biology. Hansen (1960, 1966) and Thomsen (2007) claim that both species develop in *Tilia*, and probably in *Corylus* and *Quercus*.

No specific information on host trees is linked with the Norwegian records of *S. ferrea*, but the records are from areas where *Tilia*, *Quercus*, *Corylus* and other broadleaved species are common.

Data on host trees is sparse in connection with the Norwegian records of *S. dubia*, but the species has been reared from *Tilia cordata* and found in wood of *Fraxinus excelsior*, and other tree species have most likely also been utilized.

A great number of host trees are mentioned in literature for both *S. dubia* and *S. ferrea*, and they are listed in tables 1 and 2. There is an almost unanimous agreement that *S. dubia* is a polyphagous species, exploiting many different species of deciduous trees. In regards to *S. ferrea*, the different authors’ conclusions range from a monophagous to a polyphagous mode of life (Tables 1 and 2).

We assume that the *Stenostola* species have some biological plasticity linked with geographical distribution. However, authors have cited each other and the list of host trees is a common heritage based on sources dating back to the 19th century or possibly even older. As an example, *Betula* is mentioned as a host tree by Jäger (1884) in the 4th edition of Calwer’s Käferbuch. Schaufuss mentioned *Betula* in the 5th edition, based on Jäger. Teppner (1963) refers to Schaufuss. We have not found any new documentation that *Betula* is a host tree of the genus, and consider *Betula*’s role as a host tree uncertain and in need of new documentation. In addition, many authors do not refer specifically to the source of the information. As an example, Strand (1946) mentions several host trees for *S. dubia* but no source of this information.

Based on our literature studies, we conclude that the list of host trees is mixed up due to misidentification of the beetles. It is a uniform understanding among more recent authors that *S. dubia* is polyphagous on broadleaved trees including *Tilia*, and that *S. ferrea* has a strong preference for *Tilia* (Rejzek pers. com. see Wallin et al. 2005, Svacha 2001, Böhme 2005, Svacha & Danilevsky in preparation). We also suspect that records of imagines sitting on leaves etc. have caused incorrect interpretations of the host tree. Our conclusion is that all assertions of *S. ferrea* using other host trees than *Tilia* spp. require revised or new documentation. Petr Svacha’s (pers. com.) conclusion is in agreement with ours: “…. we should better start from scratch with the hosts”.

**Tilia cordata in Norway**. *Tilia cordata* is the main host tree for *S. ferrea* and an important host tree for *S. dubia*. An understanding of the genus *Tilia* in Norway is a key factor to understanding the occurrence and distribution of the *Stenostola* species.

During the last 2000 years the amount of *Tilia* in Europe has declined for various reasons including climatic conditions and human activities like agriculture, forestry etc. (Jensen & Canger 1999, Myking & Skrøppa 2001). However, *T. cordata* is still widely distributed in Norway today (Fig. 5). The northernmost record of lime trees in the world is an isolated population at Moaksla in Brønnøy municipality, Nordland County (Hultén 1971, Frivold 1994, Nedkvitne & Gjerđåker 1997, Jensen & Canger 1999, Lid 2005).
**TABLE 1.** Host trees of *S. dubia* and *S. ferrea* outside the Nordic Countries, as presented in the literature from the 20th century. When references are marked with **it means that the host tree species or the genus is mentioned as the preferred, predominant or only one used. When references are marked with ′ it indicates a mass attack.

<table>
<thead>
<tr>
<th>Host tree</th>
<th><em>S. dubia</em></th>
<th><em>S. ferrea</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer</td>
<td>Sama 2002</td>
<td>-</td>
</tr>
<tr>
<td>Betula</td>
<td>-</td>
<td>Jäger 1884, Teppner 1963: Based on Schauffuss 1916</td>
</tr>
<tr>
<td>Carpinus betulus</td>
<td>Horion 1974</td>
<td>Teppner 1963, Burakowski et al. 1989</td>
</tr>
<tr>
<td>Corylus avellana</td>
<td>-</td>
<td>Teppner 1963, Burakowski et al. 1989</td>
</tr>
<tr>
<td>Euonymus</td>
<td>Svacha 2001</td>
<td>-</td>
</tr>
<tr>
<td>Fagaceae</td>
<td>Böhme 2005</td>
<td>-</td>
</tr>
<tr>
<td>Frangula alnus</td>
<td>-</td>
<td>Teppner 1963, Sláma 1998</td>
</tr>
<tr>
<td>Fraxinus excelsior</td>
<td>Rejzek &amp; Rébel 1999</td>
<td>-</td>
</tr>
<tr>
<td>Prunus padus</td>
<td>-</td>
<td>Teppner 1963</td>
</tr>
<tr>
<td>Prunus</td>
<td>-</td>
<td>Horion 1974 (Kirschbaum), Sláma 1998</td>
</tr>
<tr>
<td>Pyrus malus</td>
<td>Bily &amp; Mehl 1989</td>
<td>Teppner 1963</td>
</tr>
<tr>
<td>Rhamnus</td>
<td>Sama 1988, 2002, Bense 1995, Sláma 1998</td>
<td>-</td>
</tr>
<tr>
<td>Salix aurita</td>
<td>-</td>
<td>Demelt 1966, Burakowski et al. 1989</td>
</tr>
<tr>
<td>Salicaceae</td>
<td>Böhme 2005</td>
<td>-</td>
</tr>
<tr>
<td>Sorbus</td>
<td>-</td>
<td>Sláma 1998</td>
</tr>
<tr>
<td>Host tree</td>
<td>S. dubia</td>
<td>S. ferrea</td>
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<td>-----------------</td>
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<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tiliaceae</td>
<td>Böhme 2005</td>
<td>-</td>
</tr>
<tr>
<td>Ulmus scabra</td>
<td>-</td>
<td>Teppner 1969</td>
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</tbody>
</table>

*T. cordata* in Norway has very limited sexual reproduction due to low temperature. Consequently the Norwegian populations have little genetic diversity and are considered vulnerable from a genetic point of view. The reproduction in Norway is thus mainly non-sexual (Jensen & Canger 1999, Myking og Skrøppa 2001, Mong 2005). As a result approximately 70 protected areas where *Tilia* is a main tree species have been established in Norway, constituting 1544.6 ha, plus other areas where *Tilia* is present. Warmer climatic conditions will not necessarily lead to an increase in the distribution of *Tilia* in Norway, due to lack of seed germination (Myking & Skrøppa 2001).

Mong (2005) concludes that the volumes of standing stems of *Tilia* in eastern, southern and western parts of Norway are stable or with an increasing number of standing stems.

The conclusion based on recent data from the National Forest Inventory (NFI) (Eriksen 2009, Rune Eriksen pers. com.) is that the volume of *Tilia* in Norway has increased strongly since 1996 (Table 3). The increase of the standing volume and number of stems is estimated based on measurements from 38 survey plots with *T. cordata*, out of approximately 11.500 forest survey plots in Norway. Each of the plots is 250 m². The number of plots with *Tilia* is small because of the limited distribution in Norway. However, data quality is strengthened due to registration of the same permanent plots. A number of 342 stems of *Tilia* with >5cm BHD have been measured. No change in the distribution of *Tilia* is registered.

![FIGURE 5. The distribution of Tilia cordata in Scandinavia (from Hultén 1971).](image-url)
TABLE 2. The host trees of *S. dubia* and *S. ferrea* based on Fennoscandian and Danish literature from the 20th century. All host trees previously listed under *S. ferrea* from Sweden and Finland, have been transferred to *S. dubia*. When references are marked with ** it means that the host tree species or the genus is mentioned as the preferred, predominant or only one used.

<table>
<thead>
<tr>
<th>Host trees</th>
<th><em>S. dubia</em></th>
<th><em>S. ferrea</em></th>
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<tbody>
<tr>
<td><em>Alnus incana</em></td>
<td>Forsius 1925, Palm 1951, 1959, Lundberg 1967,</td>
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<tr>
<td></td>
<td>Ehnström &amp; Axelsson 2002, Heliövaara et al. 2004,</td>
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<tr>
<td></td>
<td>Ehnström &amp; Holmer 2007</td>
<td></td>
</tr>
<tr>
<td><em>Alnus</em></td>
<td>Strand 1946, Wallin et al. 2005</td>
<td>Bily &amp; Mehl 1989</td>
</tr>
<tr>
<td><em>Corylus avellana</em></td>
<td>Hansen 1966, Ehnström &amp; Axelsson 2002,</td>
<td>-</td>
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<tr>
<td></td>
<td>Ehnström &amp; Holmer 2007**, Lindhe et al. 2010**</td>
<td></td>
</tr>
<tr>
<td><em>Fagus sylvatica</em></td>
<td>Lundberg 1963, 1967, Adebrett &amp; Lundberg 1966,</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Wallin et al. 2005</td>
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</tr>
<tr>
<td><em>Fraxinus excelsior</em></td>
<td>Kvamme, unpublished data</td>
<td></td>
</tr>
<tr>
<td><em>Juglans regia</em></td>
<td>Bily &amp; Mehl 1989</td>
<td>-</td>
</tr>
<tr>
<td><em>Malus sylvestris</em></td>
<td>Wallin et al. 2005, Ehnström &amp; Holmer 2007</td>
<td>-</td>
</tr>
<tr>
<td><em>Malus</em></td>
<td>Adebrett &amp; Lundberg 1966, Lundberg 1967</td>
<td>-</td>
</tr>
<tr>
<td><em>Pyrus malus</em></td>
<td>Bily &amp; Mehl 1989</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Wallin et al. 2005, Thomsen 2007</td>
<td></td>
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<tr>
<td><em>Salix caprea</em></td>
<td>Forsius 1925, Palm 1951, 1959, Lundberg 1967,</td>
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<td></td>
<td>Ehnström &amp; Axelsson 2002, Heliövaara et al. 2004,</td>
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<td></td>
<td>Ehnström &amp; Holmer 2007</td>
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<tr>
<td><em>Sorbus aucuparia</em></td>
<td>Ehnström &amp; Axelsson 2002, Ehnström &amp; Holmer 2007**, Ehnström pers. com.,</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Lindhe et al. 2010**</td>
<td></td>
</tr>
<tr>
<td><em>Sorbus</em></td>
<td>Strand 1946, Wallin et al. 2005</td>
<td>-</td>
</tr>
<tr>
<td><em>Ulmus glabra</em></td>
<td>Ehnström &amp; Axelsson 2002, Ehnström &amp; Holmer 2007</td>
<td>-</td>
</tr>
<tr>
<td><em>Ulmus</em></td>
<td>Lundberg 1967, Bily &amp; Mehl 1989, Wallin et al. 2005</td>
<td>-</td>
</tr>
</tbody>
</table>

groups. It can be considered to have a “fragmented” distribution in the landscape. One exception is a big *T. cordata* forest in Stryn, western Norway, covering an area of 140 ha. This is probably the biggest stand of its kind in northern Europe. The forest is on a south exposed slope from 40 to 450 meters above sea level (Frivold 1994).

*T. cordata* prefers warm localities in Norway and has a preference for well drained soil, often with higher lime content. They often grow on exposed stony slopes and scree, where there is less competition from other species. Such areas are often less available and thus often less disturbed by forestry operations. *T. cordata* is considered to be a medium to shade tolerant tree species by most authors (Frivold 1994). In many cultural landscapes *T. cordata* is an important component, both when planted and occurring spontaneously. Exotic *Tilia* species have frequently been used as ornamental trees, and they may also serve
as host trees for *Stenostola* spp. The cultural landscape in Norway is less used in the traditional way as grazing land, small agricultural fields are abandoned and less firewood is harvested. The result is a more densely forested and more shaded landscape with higher humidity and cooler conditions. We evaluate this as a negative development for heat and sun loving insects.

### Biology of the species

Information on the biology of *S. dubia* in literature is limited, and even less information is specifically linked to *S. ferrea* (Table 4). Data from Sweden and Finland mentioned under *S. ferrea* has been transferred to *S. dubia*.

The differences in the biology of the two species are not fully understood. Many authors simply state that *S. ferrea* has a very similar biology to *S. dubia* without any further explanation (e.g. Hansen 1960, 1966, Harde 1966, Hellrigl 1967, Horion 1974, Bily & Mehl 1989, Bense 1995, Sláma 1998, Ehnström & Axelsson 2002, Sama 2002, Ehnström & Holmer 2007, Thomsen 2007, and others). When consulting the literature, it is clear that the information from the different sources is contradictory and mixed up (Table 4). Many authors also quote the same sources, or each other, causing a further inheritance of old mistakes. This is due to misidentifications, which is emphasized by many coleopterists (Demelt 1956, Hansen 1960, Palm 1962, Teppner 1963, Harde 1966, Skidmore & Johnson 1969, Sama 1988, Burakowski et al. 1989, Sláma 1998, Vives 2000, Heliovaara et al. 2004, Wallin et al. 2005, and others).

Based on information from recent publications (Svacha 2001, Wallin et al. 2005, Svacha & Danilevsky in prep.), communication with colleagues as well as our own experiences the state of knowledge on the biology can be summarized as following: The larvae of *S. ferrea* live in thicker twigs, branches and slender stems (sometimes up to 20 cm in diameter) of *T. cordata*. The attack can be massive and many larvae may live in the same substrate. The preferred substrates are dry. High humidity and fungal growth might be fatal for the larvae. Galleries of the larvae are usually made in the bark. The sapwood as well as the cambial layer is usually untouched, except when the bark is very thin. The mature larvae drill a typical hook-shaped pupal chamber in the wood. If the bark is thick, the pupation may take place in the bark. The pupation takes place in spring. The life cycle is one to two years. The flight period occurs in late spring to summer, and the imagines feed on the leaves and fresh bark of the host trees.

The biology of *S. dubia* resembles the biology of *S. ferrea*. However, *S. dubia* has probably a less strict demand to the quality of substrates, e.g. tolerates more humidity. Different species of host trees can be utilized and the species is polyphagous, but *T. cordata* is often preferred. Usually the attacks are less massive and only one or two eggs are laid on each place on the substrate.

### Do *S. dubia* and *S. ferrea* live sympatrically?

Hansen (1960, 1966) claims that the two species occur together. Sláma (1998) writes that they even develop together in the same substrate. However, the information on co-existence and development in the same substrate (micro-sympatric level) is contradictory. According to Rejzek & Rébel (1999) they occur in the same forest areas (macro-sympatric level) in Bohemia (Czech Republic), but strongly compete for the same substrates. Usually *S. ferrea* is the stronger competitor and occupies all suitable *Tilia* substrates while *S. dubia* is forced to use other host trees (Rejzek pers. com., see Wallin et al. 2005). When *S. dubia* and *S. ferrea* have been reared from branches

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**Table 3.** The total amount of *Tilia cordata* in Norway based on data from the National Forest Inventory (NFI). The amount of standing volume and the number of trees are estimated values based on registrations of the permanent survey plots. Only trees/stems with BHD > 5 cm were registered.

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated volume including bark (1000 m³)</th>
<th>The number of estimated <em>Tilia</em> trees in millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>774</td>
<td>8.7</td>
</tr>
<tr>
<td>2002</td>
<td>991</td>
<td>11.5</td>
</tr>
<tr>
<td>2007</td>
<td>1210</td>
<td>12.3</td>
</tr>
</tbody>
</table>
TABLE 4. Summarized information on the biology of *S. dubia* and *S. ferrea*, based on literature from the 20th century. The information is an interpretation and standardization from written sources.

<table>
<thead>
<tr>
<th></th>
<th><em>S. dubia</em></th>
<th><em>S. ferrea</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substrate</strong></td>
<td>Dying, newly dead or cut branches, stems and tops 1–12 cm in diameter</td>
<td>Slender, dead and drying branches and stems (Demelt 1956, 1966, Teppner 1963, Burakowski et al. 1989, Bense 1995)</td>
</tr>
<tr>
<td><strong>Substrate humidity</strong></td>
<td>Humid ground (Duffy 1953: Also slightly decaying, Palm 1959, Hansen 1966, Bily &amp; Mehl 1989)</td>
<td>Mostly humid ground (Demelt 1966)</td>
</tr>
<tr>
<td></td>
<td>Mostyly on dry ground (Burakowski et al. 1989)</td>
<td>Also on dry ground (Burakowski et al. 1989)</td>
</tr>
<tr>
<td></td>
<td>Dry substrates (Svacha 2001)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In the pith channels (Kryger &amp; Søndrup 1945)</td>
<td>Bark, usually not in wood (Demelt 1966, Svacha 2001)</td>
</tr>
<tr>
<td></td>
<td>Pupation take place in May–June (Ehnström &amp; Holmer 2007)</td>
<td>Pupation take place in May–June (Ehnström &amp; Holmer 2007)</td>
</tr>
<tr>
<td><strong>Pupal chamber</strong></td>
<td>Pupal chamber situated from barely furrowing the sapwood to deeper in the wood, curved and hook-shaped (Kemner 1922, Duffy 1953, Palm 1959, Hellrigl 1967, Bily &amp; Mehl 1989, Sláma 1998, Sama 2002)</td>
<td>Pupal chamber curved and hook shaped (Demelt 1956, Teppner 1963)</td>
</tr>
<tr>
<td></td>
<td>In the wood (Demelt 1966)</td>
<td>In the wood (Demelt 1966)</td>
</tr>
<tr>
<td></td>
<td>Usually in the bark (Svacha 2001, Svacha &amp; Danilevsky in prep.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recorded in July in Norway</td>
<td></td>
</tr>
<tr>
<td><strong>Development/life cycle</strong></td>
<td>1 year (Sláma 1998); probably 1 year (Hansen 1966); normally 1 year but possibly 2 years (Kemner 1922, Palm 1951, 1959: based on Kemner 1922, Bily &amp; Mehl 1989); probably 1–2 years (Ehnström &amp; Axelsson 2002); 2 years (Bily &amp; Mehl 1989, Bense 1995, Heliövaara et al. 2004, Ehnström &amp; Holmer 2007, Thompson 2007)</td>
<td>1–2 years (Demelt 1966); 2 years (Teppner 1963, Bense 1995, Ehnström &amp; Holmer 2007)</td>
</tr>
</tbody>
</table>
of Tilia in Czech Republic and Slovakia, they have never been reared from the same substrate (S. Snäll pers. com. see Wallin et al. 2005). No documentation shows that both species live in the same substrate (Wallin et al. 2005). Svacha (pers. com.) states that the two species might occur on the same substrate/tree. The question can not be fully answered without further studies.

In Stangenes (Kristiansand Municipality), S. ferrea and S. dubia live sympatrically (macro-sympatric level) in the same forested area. The beetles have been collected from firewood cut in a limited area and stored at the same place. On this basis it is difficult to evaluate how closely the species live together in the area (micro-sympatric level) or the level of competition between the species.

**Is the Norwegian population of S. ferrea a relict?** The discussion about the possibility of relict populations of *Stenostola* in Scandinavia is not new. Klefbeck (1924) raised the question about *S. dubia* (called ferrea) in Sweden, based on the records in combination with the assumption that *S. dubia* is monophagous on *Tilia*. Forsius (1925) argued against this hypothesis, based on Finnish records from *Salix caprea* and *Alnus incana*. In the Nordic countries the distribution of *S. dubia* is more or less continuous (Wallin et al. 2005, Ehnström & Holmer 2007).

*Tilia* arrived in Norway from the south in the post-glacial warm period, 7–8000 years ago. The distribution of *Tilia* in Norway was much wider 5–6000 years ago, due to a climate which was up to 2° C warmer than today (Frivold 1994, Nedkvitne & Gjerdåker 1997, Jensen & Canger 1999).

Today *Tilia* is locally rather common in the coastal and lowland areas in the southern, eastern and western Norway (Fig. 5). There are no physical barriers, such as gaps in the distribution of *Tilia* or mountain barriers, along the coast where *S. ferrea* is found and towards Sweden and Denmark (Fig. 5). The beetles are mobile and fly at least shorter distances.

Beetles may be carried long distances by the wind, passing the narrow straight between Sweden and Denmark (Baranowski & Gärdenfors 1974). However, many beetle species known from western Norway, as well as from the southern coast and islands in the Oslofjord area, are generally accepted as being relicts from warmer periods. We consider *S. ferrea* in Norway as a possibly relict population. New records are needed to fill the distributional gap between the Norwegian and the Danish populations in order to prove otherwise.

**Are the *Stenostola* species rare or threatened in Norway?** *S. dubia* is locally common and widely distributed in Norway. As shown (Tables 1–2) it is a polyphagous species. Nothing in the choice of host trees and substrates indicates a limitation in substrate availability. Neither do we have any indication of decrease of the abundance in Norway. This conclusion is in harmony with the Swedish: “… it seems that the abundance of *S. dubia* increased during the first half of the 20th century, but that it has been quite stable since.” (Lindhe et al. 2010). We thus agree with Ødegaard et al. (2006, 2010) that *S. dubia* should not be included in the red list.

*S. ferrea* was previously listed in the category Data Deficient (DD) (Ødegaard et al. 2006) with no criteria specified. In the new National Red List (Ødegaard et al. 2010) it is listed as Vulnerable (VU) based on the criteria B1ab(iii)+2ab(iii). This means that: B1: The distribution area is <20 000 km²; a: Strongly fragmented habitats or few localities; b(iii): Continuing reduction/decline of

### TABLE 4. continued

<table>
<thead>
<tr>
<th>Altitude</th>
<th><strong>S. dubia</strong></th>
<th><strong>S. ferrea</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hills and lower mountains in South Poland, probably not in the lowlands (Burakowski et al. 1989)</strong></td>
<td><strong>Lower altitudes, probably distributed in most of Poland (Burakowski et al. 1989)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Lower altitudes (Sláma 1998)</strong></td>
<td><strong>Mountains and subalpine areas (Horion 1974)</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **In Graz, at altitude 1500m (Hellrigl 1967)** |}
the distribution area or quality of habitats; + 2: Area of occupancy is <2000 km²; a and b(iii) as above.

The number of records of *S. ferrea* indicates that it is a rare species in Norway, as well as in Denmark. However, we believe that *S. ferrea* might be overlooked because of taxonomical problems and little focus on the species. It is also common that species become rarer at the outskirts of their range.

The rarity of *S. ferrea* in Norway cannot be explained by lack of available substrate. Dry branches and slender stems of *Tilia* spp., with diameters ranging from 1 cm sometimes up to 20 cm, are the preferred substrates. In regular forest operations and cutting of firewood the twigs, branches and the thinnest stems are left in the forest. The traditional agricultural landscape in Norway is gradually changing from more open sun exposed areas to denser forested and shaded land. This might be a negative factor for the species.

There is no data that indicates or shows decline or increase of the population in Norway. The record data of *S. ferrea* are not consistent in time, space, method and sampling intensity, and can not be used as basis to indicate changes in the population size. We have not found any information on population dynamics in literature from other countries, except that mass attacks have been reported on fruit trees in central Europe (Strojnowski 1961, Burakowski et al. 1989). Specimens from mass attacks should be re-examined to ensure the identity of the beetles. Neither have we any indications that the habitats are more fragmented, nor that the availability of substrates and the habitat quality are reduced. Together with the uncertainty of the distribution and abundance, the status on the red list should consequently remain data deficient (DD), not vulnerable (VU), until new data are available and prove otherwise.

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**References**


Clayhills, T. 2002. *Sarvijäärien Stenostola ferrea (Schrank) ja S. dubia (Laicharting) esiintyminen Suomessa (Coleoptera, Cerambycidae)*. *Sahlbergia* 7, 100.


Eriksen, R. 2009. *Overvåking av treslag med spredt forekomst. Registrert på oppdrag fra*


Kvamme & Wallin: The genus Stenostola in Norway


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