Host Plants of *Agrilus*

History of Host Plant Reporting

The history of publishing biological data on *Agrilus* is prolific and dates to the earliest days. There are 1,250 host related references in this study with no chance to adequately highlight all the important ones. This section is just a brief insight into several aspects of biological discovery of these splendid beetles.

The oldest *Agrilus* host plant association relates to *Betula alba* and was cited by Linné (1760) for *Buprestis viridis* (currently *Agrilus*) described 2 years earlier. The oldest known *Agrilus*-host plant associations published directly in a description are those cited for *Agrilus serraticornis* Scopoli, 1763; *A. viridicupreus* Geoffroy, 1764; *A. sexguttatus* Brahm, 1791; *A. hyperici* Creutzer, 1799; *A. sexguttatus* Herbst, 1801 and *A. lateralis* Say, 1823.

The biological reporting of earliest authors usually includes just collecting circumstances without further biological details. This approach was changed by Ratzeburg (1837, 1839a, b) who described the first *Agrilus* larvae and biology of important forest pests and by Perris (1851) and Xambeu (1893, 1898) describing larval characters and biology of additional European *Agrilus*.

The boom in biological reporting started at the beginning of the twentieth century and is continuing to the present day. The *Agrilus* related host records are usually included among biological data of other buprestids. Biological information can be found not only in entomological papers, but in a whole range of publications on forestry, agriculture, ecology, phytopathology, parasitology, and bio-control. Valuable data can be occasionally found in publications on buprestid parasitoids or predators.

Europe has the richest history of biological reporting due to long entomological tradition. Most references relate to the regional fauna and every European country has very likely its own buprestid monograph including biological data. The most

E. Jendek, J. Poláková, *Host Plants of World Agrilus (Coleoptera, Buprestidae)*,
DOI 10.1007/978-3-319-08410-7_2

important are: Central Europe – Bílý (2002); Fennoscandia and Denmark – Bílý (1982); Bulgaria – Sakalian (2003); Czech Republic – Bílý (1989); France – Schaefer (1949b), Théry (1942); Germany – Brechtel & Kostenbader (2002); Niehuis (2004); Greece – Mühle et al. (2000); Hungary – Muskovits & Hegyessy (2002); Italy – Curletti (1994b); Poland – Burakowski et al. (1985); Spain – Cobos (1986); Ukraine – Prokhorov (2010); European part of Russia – Alexeev (1959, 1961, 1981c), Il'inskij (1948, 1962), Rikhter (1948, 1950) Rikhter & Alexeev (1965).

The biology and host plants of North American *Agrilus* are also well known and reviewed in numerous publications. The most important are the revisions of Fisher (1928) dedicated exclusively to *Agrilus* and the catalog of Nelson et al. (2008) providing a comprehensive host summary for all North American *Agrilus*. The northeastern North American *Agrilus* fauna was recently reviewed by Paiero et al. (2012) compiling all known biological data. The most complete data for Canadian buprestids including *Agrilus* were published by Bright (1987). The original records on American *Agrilus* were gathered by of dozens American and Canadian entomologists like Bellamy, Chamberlin, Cockerell, Fall, Fisher, Harrington, Hespenheide, Jackman, Knull, Lockhead, MacRae, Manley, Nelson, Swaine, Verity, Wellso and Westcott. Some of them also contributed to the fauna of Mexico and adjacent countries. Their papers are cited at particular taxa.

The biology of *Agrilus* south of Mexico, despite the enormous diversity of the genus, is poorly known and can be found in references from Brazil – Sujii et al. (1996), Curletti et al. (2013); Chile – Moore Rodriguez (1985); Costa Rica – Fisher (1929); French Guiana – Curletti & Brûlé (2013, 2014); Nicaragua – Westcott & Hespenheide (2006); Panama – Curletti (2005b) and Venezuela – Hespenheide (2012).

Only a very few African *Agrilus* have known host plant associations. The information is scattered in older works of Théry (1934, 1937) and Descarpentries (1959, 1963) as well as in recent publications of Curletti (1994a, 1997, 1998b, 1999); Curletti & Bellamy (2005); Curletti & Cristano (2013); Curletti & Dutto (1999a, b); Curletti & Sakalian (2007, 2009) and Curletti & Vayssières (2007).

Asian Near East biological *Agrilus* records exist from: Israel – Halperin & Argaman (2000); Turkey – Schimitschek (1944), Niehuis & Tezcan (1993) and Yemen – Curletti & Harten (2002). The Central Asian region was explored by Russian entomologists such as Kadyrbekov et al. (2003); Kostin (1973); Tleppaeva (1999, 2013) and Volkovitsh & Alexeev (1992, 1994). The latter also provided data on *Agrilus* of Mongolia (Alexeev, 1975; Alexeev & Volkovitsh, 1989).

Many *Agrilus* hosts plant associations from the Russian Far East were cited by Alexeev (1989) and recently by Jendek & Grebennikov (2011) in the book on East Asian *Agrilus* summarizing all published hosts for all *Agrilus* known from the target area. Japan has a long tradition in exploring jewel beetle biology with the most important contribution by Akiyama & Ohmomo (1997) and Ohmomo & Fukutomi (2013). Publications of Chang-Whan Kim (1978) and Ko Je Ho (1969) were dedicated to buprestid biology of South Korea. Some publications written in Chinese, Japanese or Korean may have been overlooked.

From the Oriental region, the valuable original biological data on *Agrilus* were provided by Gardner (1929) and by Beeson (1919, 1941) from India and by Gul & Chaudhry (1980, 1983) from Pakistan. These data are the first larval records for Oriental *Agrilus*. Additional biological references on Oriental species were provided by Baudon (1968) from Laos, by Jackman (1987) and Kalshoven (1951) from the Philippines and by Verbeek (1939) from Indonesia. The summary of published data on host plants of Australian jewel beetles was recently given by Bellamy et al. (2013). This work also includes references to all cited Australian records.

Autecological publications referring usually to economically important species deserve special attention. Among the recent papers, the most important are those published by Brechtel & Kostenbader (2002) and Niehuis (2004) detailing and illustrating the biology of *Agrilus* in Germany. The original observations and life cycle of Ukrainian species were those by Prokhorov (2010). Solomon (1995) published a guide to insect borers which included also many American *Agrilus*. Ives & Wong (1988) provided biological data for important Canadian pests.

The autecology of European and American *Agrilus* was studied by many authors. The species with well-known biology are: *A. angelicus*: Brown & Eads (1965), *A. anxius*: Katovich et al. (2000), Barter (1957), *A. ater*: Kangas (1947), *A. auricollis*: Wachtl (1888), *A. biguttatus*: Wachtendorf (1955), *A. difficilis*: Akers et al. (1986), *A. granulatus*: Solomon, 1995, *A. horni*: Carlson & Knight (1969), *A. horni*: Nord et al. (1965), *A. macroderus*: Lekič (1958), *A. mendax*: Alexeev (1958a), Krogerus (1922a, b), *A. otiosus*: Solomon (1995), *A. politus*: Craighead (1950), *A. quercicola*: Sever et al. (2012), *A. ruficollis*: Cranshaw (2004), *A. salicis*: Lekič (1959) (as *A. acutangulus*), *A. sinuatus*: Fassotte (1999), Fassotte et al. (2004), *A. suvorovi*: Arru (1962) (as *A. populneus*), Grechkin (1951c) and *A. viridis*: Brück-Dyckhoff (2012), Petercord & Delb (2008), Savkovskii & Rybalov (1981).

The biology of certain *Agrilus* species was discovered because they are serious pests of cultivated plants like *Citrus*: *A. auriventris*, *A. grisator*, *A. inamoenus*, *A. occipitalis*; *Hibiscus*: *A. acutus*; *Malus*: *A. sinuatus*, *A. mali*; *Pyrus*: *A. sinuatus*; *Ribes*: *A. ribesi*; *Rosa*: *A. cuprescens*; *Rubus*: *A. cuprescens A. ruficollis*; *Zanthoxylum*: *A. zanthoxylumi*. References to these host plant associations can be found in the *Agrilus* – host plant catalog.

Invasive species present a special category and among them, *Agrilus planipennis*, the notorious pest of *Fraxinus*, has the dominant position. Before its introduction to the North American continent and later to the European part of Russia, *Agrilus planipennis* was known from just a few records. Its outbreak in North America however, has triggered an enormous interest in this species resulting in numerous studies. This species is probably the best studied *Agrilus* and, perhaps, buprestid generally.

Agrilus-host plant associations were summarized and revised only on a regional level. The most important recent publications on North American (Nelson et al., 2008) and Australian (Bellamy et al., 2013) *Agrilus* fauna provide a summary of host plants without critical revision or analyses. Similarly, three European papers

by Bílý (2002), Brechtel & Kostenbader (2002) and Niehuis (2004) offer no critical assessment of cited *Agrilus* host plant associations.

Among the publications reviewing *Agrilus* – host plant associations, only two of them, Horion (1955) and Hellrigl (1978) provide a critical host plant assessment of European *Agrilus* together with other buprestids. Hellrigl (1978) was the first author who made the clear distinction between original and subsequent host plant records, highlighted larval ones and excluded erroneous records. These two publications present the first attempt to provide a critical revision of compiled data and serve as an inspiration for our work.

Larval and Adult Host Plants

In the genus *Agrilus*, the destructive insect-plant interactions are almost exclusively the result of larval activity. The larva lives 1–3 years which is by far the longest and most important stage of the whole life cycle. To reach sexual maturity, adults also need feeding and the adult host plant is typically the same plant species as the larval host plant. Adult feeding poses insignificant impact compared with more severe larval damage.

The larval host plant of a particular *Agrilus* species-group taxon is the plant where its larva develops. The adult host is usually seen the plant on which the adult feeds, but in the broad sense adopted in this study, it is a plant reported in relation with adult occurrence. The reason for adult occurrence on the plant varies from purely accidental to biologically predetermined like emergence or oviposition. Adult host records are frequently the only data available for many *Agrilus* taxa and despite the high rate of uncertainty, they might, in many cases, refer to the actual larval host plant.

Host Plant Reporting

Host related records Published host related records are loaded with many compromising uncertainties. The host plant reporting has no standard which would guarantee their reliability. The reverse verification is impossible due to lack of voucher specimens either of *Agrilus* or plants. Many host related records remained undisclosed because of being cited by vernacular names. This practice is common in all languages, but most critical in publications written in Chinese, Japanese, Korean or Russian.

In the process of host plant reporting, original records play the primary role because of bearing new or original information. The original records must be clearly distinguished from subsequent, secondary records with no new information. However, adopted information in subsequent records is often published without reference to the original source and are therefore difficult to distinguish.

The original records are often mere declarations lacking any additional data like details from rearing, locality labels, deposition of specimens, images of plants or galleries supporting the new biological information and allowing verification. The most valuable original records are those based on larval activity. The original larval records are often not declared even in some recent publications.

The taxonomy and nomenclature of both, *Agrilus* and host plants are still dynamic and resulting in frequent changes of names used for the same subject. All records cited by synonymic names were assigned to valid species-group taxa from adopted systems of *Agrilus* and host plants (for more details see section "Data Sources" in chapter "Methods").

Host plant associations The only way to evaluate the credibility of a particular *Agrilus* – host plant association is by means of relevant original records. Independently published original records supporting the same *Agrilus* – host plant association increase its credibility. The more independent sources the higher the credibility of the particular *Agrilus* – host plant association. The records with highest value are those referring to the larval activity and are well supported by original data.

The quality of records might by ruined by misidentification or misconception either of *Agrilus* or the host plant. Misidentifications in hyper-diverse genera like *Agrilus* are very common mostly in older references. The taxon misconception is the special case of misidentification and means misinterpretation of the concept of particular taxon.

Records introducing false *Agrilus* – host plant association are very difficult to disprove without reverse identification of voucher specimens. The only way to eliminate them is, perhaps, detailed knowledge on the biology of a particular *Agrilus* taxon, which would allow excluding those implausible plant associations from the proven host range.

http://www.springer.com/978-3-319-08409-1

Host Plants of World Agrilus (Coleoptera, Buprestidae)
A Critical Review
Jendek, E.; Poláková, J.
2014, LXIII, 706 p. 88 illus., 86 illus. in color., Hardcover
ISBN: 978-3-319-08409-1