

New records of insect herbivory on American cranberry in Finland

K.S. Shameer¹, Leila Karami¹, Jonna S. Pärssinen¹, Veikko I.O. Yrjölä^{2,3}, Lauri Kaila³, Erkkä Laine², Ian C.W. Hardy¹ and Pauliina Palonen¹

¹ Department of Agricultural Sciences, University of Helsinki, P.O. Box 27, FI-00014, Finland

² Faculty of Natural Sciences, University of Oulu, Pentti Kaiteran katu 1, 90570, Finland

³ Finnish Museum of Natural History (LUOMUS), Pohjoinen Rautatiekatu 13, 00100, Helsinki, Finland

e-mail: shameer.ks@helsinki.fi

American cranberry (*Vaccinium macrocarpon*) is a native North American fruit crop, cultivated mainly in a small number of countries, including the USA, Canada, Chile in the New World and Türkiye, Germany, Belarus, Poland and Sweden in Eurasia. In Finland, experimental and commercial cultivation of American cranberries has recently been initiated, developing new technology for soilless table-top cultivation in high plastic tunnels. Here we report, for the first time, that *Aphis fabae*, a polyphagous aphid and eight species of lepidopterans (moth larvae) feed on American cranberry plants in Finland. Six species of lepidopterans belong to the family Noctuidae (*Lacanobia contigua*, *Lacanobia oleracea*, *Xestia baja*, *Anarta trifolii*, *Xanthia togata* and *Amphipyra pyramidea*) and two species to the family Geometridae (*Biston betularia* and *Hypomecis roboraria*). These insects may become pests of economic importance to Finnish producers. All insects reported in this study have established populations in Finland, feeding on many deciduous trees and herbaceous grasses. The proximity of landscapes containing such plants might have influenced migration of these insects into the cranberry crop.

Key words: *Vaccinium macrocarpon*, insect pests, high plastic tunnels, Noctuidae, Geometridae, Aphididae

Introduction

American cranberry (*Vaccinium macrocarpon* Aiton) is a perennial plant native to North America and is extensively cultivated in the USA and Canada (Ben-Zvi and Rodriguez-Saona 2023), with its fruits (berries) being considered as a superfood because of the presence of vitamins C, E, K, and fibers (Cobos and Díaz 2023) and due to its antimicrobial and antioxidant properties (Nemzer et al. 2022). This crop is mainly grown in acidic soils (Eck 1990) and hence is often cultivated in bogs and wetlands (Kennedy et al. 2016). Outside of the USA and Canada, other major American cranberry producers are Chile, Türkiye (Ben-Zvi and Rodriguez-Saona 2023), Germany, Sweden, Poland and Belarus (Kuptsova and Kopoteva 2020, Lenkovets 2022). Worldwide cranberry production has increased recently with American cranberry cultivation being started in many European countries (FAOSTAT 2022, Lenkovets 2022), including Finland.

Vaccinium oxycoccos L. (common cranberry or European cranberry) and *V. microcarpum* (Turcz. ex Rupr.) Schmalh. (small cranberry) are the two cranberry species native to Finland, with the former widely distributed throughout the country, except for Lapland, and the latter mainly in the northern regions (Hiirsalmi and Lehmushovi 1993). *Vaccinium oxycoccos* has a wider geographical distribution in forest areas of Europe, Asia and North America and is cultivated in Russia, Estonia and Lithuania (Česonienė et al. 2013, Jurikova et al. 2019). However, these native species of cranberry are not commercially cultivated in Finland. Recently in Finland, technology for cultivation of American cranberry, involving soilless table-top planting in high plastic tunnels, has been developed and is giving high yields (Palonen et al. 2025). This has prompted a small number of berry growers in Finland to start American cranberry cultivation in their farms, indicating a promising future for American cranberry cultivation in Finland (Palonen and Pärssinen 2025).

Ongoing research in Finland has been focused on a range of aspects of the new cultivation technology such as the nutrient requirements of the plants, pruning practices, suitability of the substrate culture, and effects of Nordic growing conditions on fruit quality, but there have not previously been any assessments of insects that might function as pests of American cranberry in Finland. Although Ben-Zvi and Rodriguez-Saona (2023) reported that all the publications pertaining to cranberry pests and their control came from the USA (84%) and Canada (16%), Gorlenko and Buga (1996) listed the pest species on cranberry plants in Belarus (note that the information within this publication is very difficult to obtain directly and thus to verify): we know of no other pest assessments within Europe. Here we provide such a study and report the insects that feed on American cranberry plants grown in Finland. We also provide a brief summary of each of these identified species from the available literature and discuss their potential to become economic pests in Finland.

Materials and methods

This study was carried out on the Viikki campus of the University of Helsinki (60°13'N; 25°01'E) from May to August in 2023, 2024 and 2025. American cranberry plants grown in pots, with forest plant peat as the substrate material, and maintained for research by the Cranberry Science Group in the Department of Agricultural Sciences, University of Helsinki, were observed for incidence of insect herbivory. Among the observed plants, four hundred plants were grown in a high plastic tunnel (L 35 m × W 8 m × H 4 m), forty plants were kept outside of the tunnel, sixty-two plants were kept in the open field near the greenhouse, and ten plants in a sandbed (130 × 85cm) outside the greenhouse. The high plastic tunnel was closed along its length and open at both ends but with wide-meshed metallic nets placed along the ground at the ends to prevent access by rabbits and similar small vertebrate herbivores that could damage the plants: insects could thus readily enter the tunnel via its open ends.

The mean daily temperature inside the tunnel during the study period ranged between 13–21 °C in 2023, 12–22 °C in 2024 and 21–25 °C in 2025, and the relative humidity ranged between 61–72% in 2023, 50–66% in 2024 and 56–67% in 2025. The temperature inside the tunnel was higher, especially around mid-day, and the temperature difference between inside and outside the tunnel varied considerably depending on the day, ranging from 2 to 6 °C.

The cranberry plants were observed on alternate days during the study period. All adult and immature stages of insects feeding directly on the leaves and berries of the cranberry plants were recorded and taken to the laboratory. Collected aphid colonies were transferred separately into containers and stored in a refrigerator prior to identification. Collected larvae (caterpillars) of lepidopterans (moths) found feeding on the plants were reared on cranberry leaves until pupation in plastic containers closed with cloth. After pupation, individuals were transferred to a fresh container until the adult insect emerged. Emerged adult lepidopterans and aphids were identified by specialists among the authors, Lauri Kaila and Erkkä Laine, respectively.

Results

Identities of insects observed

No feeding by insects was observed on American cranberry plants that were kept outside of the tunnel and in the open area near the greenhouse. Within the tunnel both aphids and lepidopteran caterpillars were found feeding on cranberry plants. Some of the caterpillars failed to pupate following transfer to the laboratory, but their identifications are also reported in this study along with those lepidopterans whose adults emerged in the laboratory. The aphids were identified as *Aphis fabae* Scopoli, 1763 (Hemiptera: Aphididae). The lepidopterans were identified as belonging to six species within the family Noctuidae: *Lacanobia contigua* (Denis and Schiffermüller, 1775), *Lacanobia oleracea* (Linnaeus, 1758), *Xestia baja* (Denis and Schiffermüller, 1775), *Anarta trifolii* (Hufnagel, 1766), *Xanthia togata* (Esper, 1788) and *Amphipyra pyramidea* (Linnaeus, 1758) and two species within the family Geometridae: *Biston betularia* (Linnaeus, 1758) and *Hypomecis roboraria* (Denis and Schiffermüller, 1775). Further details concerning overwintering and emergence are given below. While searching for herbivores, several generalist predatory insects, such as coccinellid beetles and lacewings, and ants (tending the aphid colonies) were also observed inside the tunnel.

Brief notes on the herbivorous insects identified

Here we summarize literature information on the aphids and the six lepidopterans that we have identified as feeding on American cranberries in Finland.

Aphis fabae

Aphis fabae Scopoli, 1763 (Black bean aphid) is commonly found in Southern Finland with established populations from June to September (Finnish Biodiversity Information, FinBIF 2025). Both adults and nymphs suck sap from stems and leaves of plants. They are polyphagous and feed on a wide variety of host plants, both cultivated crops and wild plants (Ellis 2025). These aphids were found feeding on American cranberry plants inside the tunnel during June–Sept months throughout the observation period. In Finland, this aphid is a common pest of faba beans and several other host plants (Skovgard and Stoddard 2023). They overwinter in egg stage on *Euonymus europaeus* L. (spindle tree) and migrate to faba bean and other plants (Skovgard and Stoddard 2023, Ellis 2025, iNaturalist 2025).

Lacanobia contigua

Lacanobia contigua (Denis and Schifferrmüller, 1775) (Arrow-spotted herb moth) (Fig. 1) is commonly found in Southern Finland with stable populations from June to August (FinBIF 2025). The larvae feed on leaves and fruits. The pupa observed in this study overwintered in 2023 and emerged in 2024. *Lacanobia contigua* is polyphagous, and in Finland, found feeding on *Vaccinium myrtillus* L. (bilberry), *V. uliginosum* L. (bog bilberry) and a wide variety of various trees, bushes and herbaceous plants belonging to the families Betulaceae, Umbelliferae, Ranunculaceae, Cruciferae, Salicaceae, Dennstaedtiaceae, Crassulaceae, Urticaceae and Ericaceae (Robinson et al. 2023).

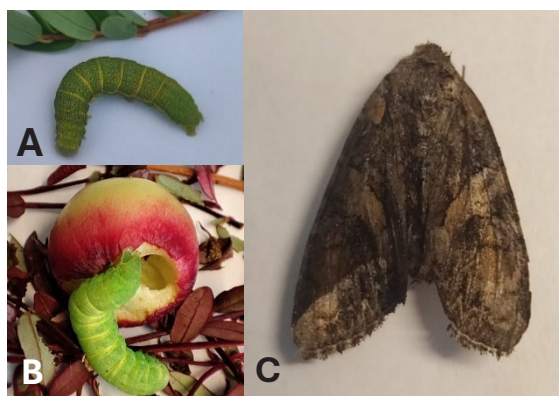


Fig. 1. *Lacanobia contigua*. A. Late larval stage, B. Larva feeding on American cranberry, C. Adult (Photos: L. Karami & K.S. Shameer)

Lacanobia oleracea

Lacanobia oleracea (Linnaeus, 1758) (Bright-line brown-eye moth) (Fig. 2) is commonly found throughout Finland, but especially in the south, with stable populations from June to August (FinBIF 2025). The pupa observed in this study overwintered in 2023 and emerged in 2024. The larvae are polyphagous and feed on various herbaceous plants, including *Atriplex* sp. (salt bushes), *Chenopodium album* L. (goosefoot), *Rumex* spp. (sorrels), *Brassica* sp. (cabbages), *Cirsium arvense* (L.) Scop. (field thistle), *Sonchus arvensis* L. (Perennial sow thistle), *Plantago major* L. (broadleaf plantain), *Polygonum* spp. (knotweed), *Alopecurus pratensis* L. (meadow foxtail), *Taraxacum* spp. (dandelions) etc. (Robinson et al. 2023).



Fig. 2. *Lacanobia oleracea*. A. Larval stage, B. Adult (Photos: L. Karami & K.S. Shameer)

Xestia baja

Xestia baja (Denis and Schifferrmüller, 1775) (Baja ground owl or Spotted nightjar) (Fig. 3) is commonly found throughout Finland, especially Southern Finland, with stable populations from July to August (FinBIF 2025). The pupa observed in this study overwintered in 2023 and emerged in 2024. Larvae are polyphagous and in Finland

feed on *V. myrtillus* L. (bilberry), *V. uliginosum* L. (bog bilberry), *Betula pendula* Roth (birch), *Salix phylicifolia* L. (willow), *Rubus idaeus* L. (raspberry), *Rheum raphanistrum* L. (rhubarb), *Antirrhinum majus* L. (snapdragon) and other plants (Robinson et al. 2023).

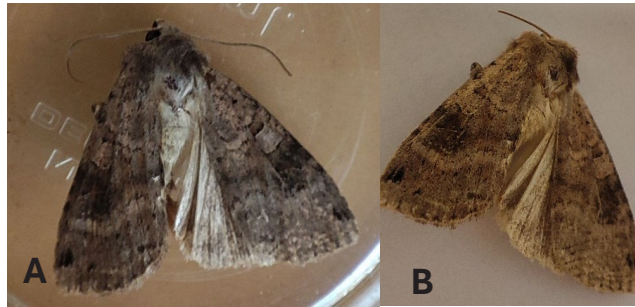


Fig. 3. *Xestia baja*. A & B Adults (Photos: L. Karami & K.S. Shameer)

Anarta trifolii

Anarta trifolii (Hufnagel, 1766) (Clover cutworm) (Fig. 4) is commonly found throughout Finland, especially in Southern Finland with stable populations from July to August (FinBIF 2025). The pupa observed in this study overwintered in 2023 and emerged in 2024. Larvae are polyphagous and in Finland, feed on *Chenopodium album* (goosefoot), *Atriplex* spp. (saltbushes) and *Allium cepa* L. (onion) (Robinson et al. 2023). The larvae are also reported to feed on *Asparagus officinalis* L. (asparagus), *Beta vulgaris* L. (beetroot), *Brassica oleracea* L. (cabbage), *Convolvulus arvensis* L. (field bindweed), *Lactuca* spp. (lettuce), *Lycopersicon* spp. (tomato), *Rumex* spp. (sorrels), *Salix caprea* L. (goat willow), *Trifolium* spp. (clovers), *Urtica* spp. (nettles) and *Vaccinium* spp. (blueberries) (Kuopio Natural History Museum 2025).



Fig. 4. *Anarta trifolii*. Adult (Photo: L. Karami & K.S. Shameer)

Xanthia togata

Xanthia togata (Esper, 1788) (Violet-winged owl) (Fig. 5) is commonly found throughout Finland, especially in the south, with stable populations during August and September (FinBIF 2025). This species overwinters as eggs and the adult observed in this study accordingly emerged from the pupa in the same year, 2023, it was collected. Larvae are polyphagous and in Finland, feed on *Salix caprea* (goat willow) and *Prunus padus* (bird cherry) (Robinson et al. 2023). The larvae are also reported to feed on *V. uliginosum* (bog bilberry) (Ziegler 2025), and *Populus tremula* L. (aspen), *Plantago* sp. (plantains), *Rumex* sp. (sorrels) and *Rubus idaeus* (raspberry) (Finnish Butterfly Society 2025).



Fig. 5. *Xanthia togata*. A. Late larval stage, B. Adult (Photos: L. Karami & K.S. Shameer)

Amphipyra pyramidea

Amphipyra pyramidea (Linnaeus, 1758) (Copper underwing) (Fig. 6) is commonly found in Southern Finland with stable populations from July to September (FinBIF 2025). This species overwinters as eggs and the adult observed in this study emerged from its pupa in the year (2025) it was collected. Larvae are polyphagous and feed on *Syringa* spp. (lilacs), *Quercus* spp. (oak trees) and *Lonicera* spp. (honeysuckle) in Finland and on *Fraxinus* spp. (ash trees), *Ligustrum* spp. (privets), *Malus* spp. (apple), *Rhododendron* spp., *Rosa* spp. (roses), *Sorbus torminalis* (wild service tree) etc. in other countries (Robinson et al. 2023).

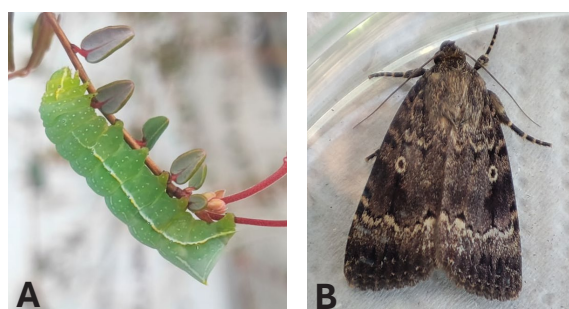


Fig. 6. *Amphipyra pyramidea*. A. Late larval stage, B. Adult (Photos: L. Karami & K.S. Shameer)

Biston betularia

Biston betularia (Linnaeus, 1758) (Peppered moth) (Fig. 7) is commonly found in Southern Finland with established populations from June to August (FinBIF 2025). This species overwinters in the ground as pupae. Larvae are polyphagous and in Finland they feed on *Betula* spp. (birches), *Salix* spp. (willows), *Populus* spp. (poplars), *Quercus robur* L. (English oak), *Ribes* spp. (currants), *Rosa* spp. (roses), *Rubus idaeus* L. (red raspberry), *Prunus padus* L. (bird cherry) and *Artemisia* spp. (mugworts) (FinBIF 2025).



Fig. 7. *Biston betularia* larval stage (Photo: L. Karami & K.S. Shameer)

Hypomecis roboraria

Hypomecis roboraria (Denis and Schiffmüller, 1775) (Great oak beauty) (Fig. 8) is commonly found in Southern Finland with stable populations from June to August (FinBIF 2025). This species overwinters in the larval stage. The larvae are polyphagous and, in Finland, feeds mainly on deciduous trees, such as *Betula* spp. (birches), *Alnus incana* (L.) Moench (grey alder), *Malus domestica* (Suckow) Borkh. (apple), *Prunus padus* L. (bird cherry) and *Quercus robur* L. (English oak) (FinBIF 2025).



Fig. 8. *Hypomecis roboraria* larval stage (Photo: L. Karami & K.S. Shameer)

Discussion

This is the first report of insects feeding on American cranberry plants grown in Finland. Further, the species identified in this study have not been reported to attack American cranberry in any of the major cranberry growing countries, viz. Canada, USA, Chile and Türkiye. All the insect species we observed on American cranberry are polyphagous and were already known as herbivores on, and often pests of, a wide variety of plants in Finland (Robinson et al. 2023, FinBIF 2025). For instance, the aphid observed in this study belonged to the species *Aphis fabae*, which is a cosmopolitan pest of more than two hundred species of plants (Ellis 2025) and is a serious pest of faba bean in Finland (Skovgard and Stoddard 2023). However, the taxonomy of *A. fabae* is partly unresolved and the species may turn out to be a cryptic species complex. Since all the reported insects have established presence with stable populations and attack a wide variety of plants in Finland (Robinson et al. 2023, FinBIF 2025), there is a clear potential for these polyphagous insects to become pests of American Cranberry in Finland.

The lepidopterans reported in this study belong to the families Noctuidae and Geometridae. A search for the reported distributions of these moths showed that *L. contigua* and *L. oelacea* are mainly found only in Europe (Robinson et al. 2023, Insecta.pro 2025). In addition to Europe, *X. baja*, *A. trifolii* and *A. pyramidea* are also found in the European parts of Türkiye, and *X. baja*, *A. trifolii* and *X. togata* are also reported from North America (Robinson et al. 2023; Insecta.pro 2025), but not as pests of cranberry plants. In addition to Finland and other parts of Europe, *Biston betularia* are also reported from North America, and *H. roboraria* are reported from Japan (Robinson et al. 2023). None of the species we observed have been reported from Chile.

We note that both aphids and lepidopterans were observed feeding on cranberry plants within the tunnel, where temperatures were higher than outside. This could be due to the fact that elevated temperatures have been linked to increased feeding, growth, reproduction and expansion of host range in herbivores and arthropod pests (Deutsch et al. 2018, Teodoro-Paulo et al. 2025). Paudel et al. (2020) reported that the effects of higher temperatures on plant–herbivore interactions can act via enhancement of herbivore growth rates while simultaneously reducing plant growth and weakening their defensive capacity, thereby increasing pest proliferation.

The surrounding area of the high tunnel, where the insects were observed feeding on cranberry plants, includes the Viikki research farm and the Viikki arboretum (both part of the University of Helsinki). The Viikki arboretum is just a few hundred meters away from the area where the high tunnel is situated and has many deciduous trees such as willows and oaks. The Viikki farm area contains many herbaceous grasses. Most of the insects reported in this study are herbivores on deciduous trees and herbaceous grasses. It is thus possible, if not likely, that these insects migrated into the high tunnel from these areas.

Prior evidence of insects attacking American cranberry and their control

Information on the common pests of American cranberry has been compiled by Dittl and Kummer (1997) and Fitzpatrick et al. (2014). The former listed ten lepidopterans, three coleopterans (beetles) and one dipteran (midge) as major pests in Wisconsin (the major US cranberry producing region), and the latter listed thirteen lepidopterans, three coleopterans, three dipterans (flies) and one hemipteran (coccid, scale insect) as pests in British Columbia (the largest producer in Canada). Ben-Zvi and Rodriguez-Saona (2023) listed 31 insect pests, attacking cranberry plants in the major cranberry-producing countries, such as the USA and Canada, belonging to the Lepidoptera (15 species), the Coleoptera (8 species), the Hemiptera (4 species of true bugs), the Diptera (1 species) and the Orthoptera (1 species). Most of these species are native to North America with a few exceptions such as *Lymantria dispar* (Lepidoptera: Erebididae) and *Otiorhyncus sulcatus* (Coleoptera: Curculionidae), which are invasive from Europe, and *Anomala orientalis* (Coleoptera: Scarabaeidae), which is invasive from Asia. Prior reports suggest that the cranberry-producing regions in North America may have different pest complexes because of their geographical separation (Ben-Zvi and Rodriguez-Saona 2023). However, one major pest, *Sparganothis sulfureana* (Lepidoptera: Tortricidae), is widely distributed across North America (Deutsch et al. 2015).

In North America, growers have been employing Integrated Pest Management (IPM) approaches, such as reduced-risk insecticides (Rodriguez-Saona et al. 2016), pheromones of cranberry insect pests for trapping and mating disruption (Rodriguez-Saona et al. 2020a), the deployment of biological control agents, such as entomopathogenic nematodes for soil insect pests (Hayes et al. 1999, Koppenhöfer et al. 2008, Ye et al. 2018, Foye and Steffan 2019), coccinellid beetles (Salamanca et al. 2019), lacewings (Neuroptera) (de Lange et al. 2019, Salamanca et al. 2019), syrphid flies (Rodriguez-Saona et al. 2020b) and parasitoid wasps (Hymenoptera) (Stuart and Polavarapu 2000, Drolet et al. 2019).

In Europe, pests of American cranberry grown in Belarus are listed by Gorlenko and Buga (1996) but this publication is very difficult to access in full and we have only been able to obtain information from it indirectly, a process that may have generated errors. We limit our discussion to noting that both aphids and lepidopterans appear to be present as pests and that the lepidopterans reported include geometrids (two species of which we also found) and tortricids and lasiocampids (of which we found none) but not, or not clearly, any noctuids (of which we found six species). Other insect pests apparently listed by Gorlenko and Buga (1996) include non-aphid hemipterans (coccoids and heteropterans), coleopterans (including curculionids and chrysomelids), dipterans and hymenopterans (sawflies). These additional species may thus be expected as likely future colonizers of American cranberry crops grown in Finland.

Prospects for agro-ecological research

The importance of the pest assemblage we report on a new crop in Finland should ideally be evaluated in an agro-ecological context. This initial report focused on the incidence of species (all of which are already-present local generalists, rather than herbivores native to American cranberries region of origin); future work could evaluate prevalence (population size and dynamics), phenology (timing of attack in relation to crop development), the extent of damage each species causes, and the interrelationships between these species and other members of the (developing) agro-ecological community (e.g. Jervis et al. 2023, Sunderland et al. 2023, Shameer and Hardy 2024). Prevalence may be influenced by surrounding landscapes and the presence of alternative host plants which could promote switching and host range expansion by these polyphagous herbivores into American cranberry crops in Finland. If the herbivores we report, or others that have not yet to become herbivores of this locally-novel crop (Brändle et al. 2008, Forister and Wilson 2013), do acquire commercial pest status for cranberries in Finland, records of their natural enemies (e.g. predators and parasitoids) will become valuable and enhance the likelihood of developing sustainable pest control approaches, for instance via augmentation and/or conservation biocontrol (Heimpel and Mills 2017). In this context it may be significant that during the present study we also found some generalist predatory insects, such as coccinellid beetles and lacewings, inside the tunnels. These may be preying on various life-history stages of the herbivores observed and thus exerting some degree of pest population control.

Conclusions

All of the insects that are reported here as herbivores of cultivated American cranberries are already known to be present, with stable populations in Finland and are pests of other plant species (Robinson et al. 2023, FinBIF 2025). As these reported insects are polyphagous, they may be able to survive on cranberries

in the same way as the invasive pests feeding on cranberries in North America (Rodriguez-Saona et al. 2011). As American cranberry cultivation in Finland is currently intensifying, the present report of the species that feed on this newly adopted crop forms a starting point for future monitoring and possible pest control strategies. More detailed studies of the herbivores of American cranberry and their natural enemies in Finland are likely to lead to a useful assessment of likely cranberry plant-insect community interactions.

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