

# HARMFUL LEPIDOPTERA IN CZECHIA – CURRENT STATUS, CHANGES AND IMPORTANCE

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## Abstract

An analysis of the current harmfulness of moths and butterflies (Lepidoptera) in Czechia was carried out. In total, about 50 species (1.4% of the Czech fauna) of regular or at least occasional pests with a not insignificant economic importance are registered. Of these, 16 (30%) damage field and garden crops, 15 (28%) fruit trees and grapevine, 7 (13%) ornamental greenery, 6 (12%) forest trees and 9 (17%) stored materials. The causes of possible changes in species composition and pest abundance are briefly discussed. The species spectrum of pests has clearly narrowed over the last decades. The loss of harmfulness has usually occurred in less significant, but also in some formerly important pests. The increase of new pests is minimal. In the last 30 years, two newly introduced harmful non-native (invasive) species (*Cameraria ohridella* and *Cydalima perspectalis*) were recorded (4 since the mid-20<sup>th</sup> century). No new Lepidoptera pests have been registered during this period, which have spread spontaneously into Czechia, e.g. due to climate change.

Keywords: Lepidoptera, pests, agriculture, silviculture, ornamental greenery, stored materials

## INTRODUCTION

Moths and butterflies (Lepidoptera), with approximately 160,000 described species (e.g. Kawahara *et al.*, 2019), are the fourth most abundant insect order both globally and in Central Europe, after Diptera, Hymenoptera and Coleoptera. But while saprophagous species are apparently predominant among Diptera, parasitoids make up a significant proportion of Hymenoptera, and Coleoptera (beetles) are a trophically very diverse group, Lepidoptera are largely homogeneous in their trophic orientation. More than 90% of them are phylophagous or feeding on other soft parts of plants, small, more or less comparable proportions are xylophagous and saprophagous, and only a minimum of species are predators. Apart from a negligible number of predators, moth and butterfly species (their caterpillars) consume various parts of growing plants (leaves, buds, flowers, fruits, wood, roots, etc.) or their dead parts. If they are attached to productive, ornamental

or otherwise practically exploited plants, and in particular to the exploited parts of these plants (especially fruits), they can cause damage of varying severity depending on their abundance and the importance of the plant concerned. Under Central European conditions, for example, Baudyš (1935) reported about 180 Lepidoptera pests, Miller (1956) about 125, Kúdela and Kocourek *et al.* (2002) as many as 575. However, many of these species are considered as pests rather theoretically, e.g. they occur in very low abundances, develop at a time of year when they cannot cause damage, or their host plant has no practical use. An attempt to assess changes in Lepidoptera harmfulness in Czechia over the 20<sup>th</sup> century was made by Šefrová (2003), who collected records of 97 species damaging field, garden and ornamental plants over that period (i.e. her analysis did not include forest and store pests). Křístek and Urban (2004) listed 96 species of Lepidoptera in their Forest entomology, but many of them only for the sake of completeness of the presented systematic review.

The aim of this work was to analyse the actual (about last 30 years) harmfulness of moths and butterflies of all the above groups in Czechia, i.e. species harmful to field and garden crops, fruit trees, ornamental plants, forestry and stored materials, to find out how many of pest species there are, what is their proportion in the above subgroups, and to divide them into species with significant negative economic importance (with a need for continuous monitoring, signalling and control) and occasional pests, whose control usually has to be dealt with on an ad hoc basis according to the specific situation. Therefore, we do not consider as pests here species whose negligible “harmfulness” is not addressed and is not of economic or general practical importance, as well as, for example, species only because of their trophic association with a particular exploited plant or because of development within farm buildings.

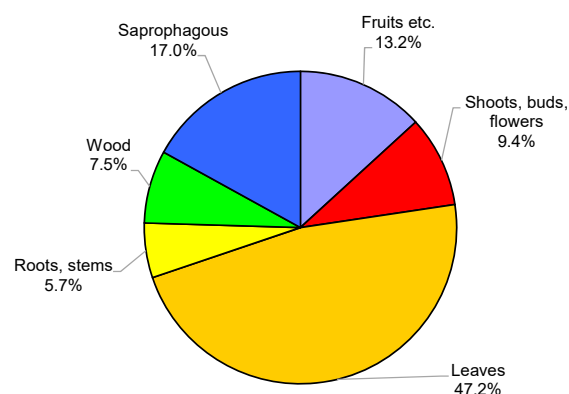
## MATERIALS AND METHODS

The analysis of moths and butterfly harmfulness was based on literature data, unpublished reports, the authors' own field experience over the past 40–50 years, knowledge from public and practitioners, and consultations with plant or forest protectionists. Pest species are divided (as far as possible) into 5 groups: pests of field and garden plants, of fruit trees and grapevine, ornamental plants, forest trees and stored materials. Species harmful in greenhouses are assigned to field and garden pests due to their small number. Some of pests are damaging on plants of more than one of these groups and are counted where their harmfulness is the most significant. The scientific names of the listed species are according to Laštůvka and Liška (2011). The national Czech names of species are also given in the tables for the possible practical usefulness of this overview.

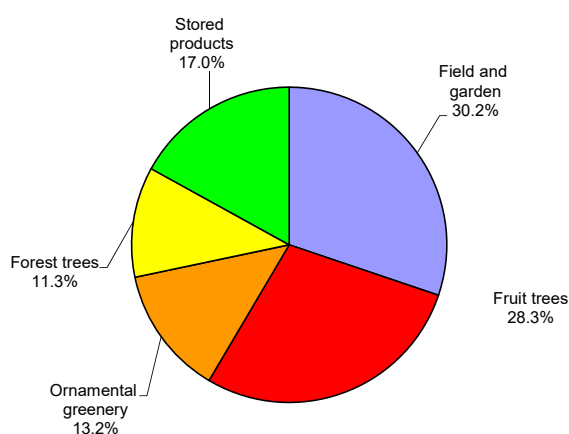
## RESULTS

**General overview.** Within Czechia, about 50 species of moths and butterflies can be considered pests (1.4% of the total number of species), of which about one-third are more important and regular, and the rest are occasional pests. Of these, 7 (13%) damage fruits or other directly used parts of plants, 5 (9%) damage buds or flowers, 25 (47%) damage (chew, sclerotize, mine) leaves, 3 (6%) damage roots or eat stems of herbs, 4 (8%) develop in woody parts of plants (bark, bast, wood) and 9 (17%) degrade stored products and other materials (Fig. 1). If we divide the harmful species after crop groups, 16 (30%) of them damage field and garden crops, 15 (28%) fruit trees and grapevine, 7 (13%) ornamental foliage, 6 (12%) forest trees and 9 (17%) stored materials (Fig. 2).

**Pests of field and garden crops** (Tab. 1). A total of 15 pest species, and the genus *Cnephasia*



1: Proportions of harmful butterfly and moth species on plant parts infested



2: Proportions of harmful butterfly and moth species on different plant groups/other substrates

as a whole, are recorded in this group, i.e. 30% of the Lepidoptera pests. The most common *Cnephasia* species with the highest pest potential are *C. asseclana* (Den. & Schiff.), *C. pumicana* (Zeller) and *C. stephensiana* (Doubleday). Among pests of field and garden crops, non-specialised polyphages, damaging leaves or other plant parts at the same time, slightly predominate. However, some of the polyphages prefer only certain cultivated plants and then only damage them, thus becoming more or less specialists in agriculture, e.g. *Lacanobia oleracea*, *Mamestra brassicae* and *Ostrinia nubilalis*. The food specialists, restricted to a narrow range of plants of a single family, are *Cydia nigricana*, *Grapholita delienseana*, *Pieris* spp. and *Plutella xylostella*. *Ostrinia nubilalis* is continuously monitored and regulated in the maize, some of the others are monitored occasionally, but control interventions are approached rather exceptionally according to the current situation. We also include two species (*Tuta absoluta* and *Chrysodeixis chalcites*) repeatedly introduced with tomato seedlings into greenhouses, where they can cause significant short-term damage. Some polyphagous pests of the next group, especially *Noctua* spp., can also damage field and garden crops.

## I: Pests of field and garden crops

Scientific name	Czech name	Food – host plant	Part of the plant
<i>Agrotis segetum</i> (Den. & Schiff.)	Osenice polní	polyphagous	leaf, root
<i>Autographa gamma</i> (Linnaeus)	Kovolesklec gama	polyphagous, <i>Brassica</i> , <i>Beta</i>	leaf
<i>Chrysodeixis chalcites</i> (Esper)	Kovolesklec jižní	polyphagous, greenhouses	leaf
<i>Cnephasia</i> spp.	Obaleč	polyphagous	leaf
<i>Cydia nigricana</i> (Fabricius)	Obaleč hrachový	Fabaceae, <i>Pisum</i>	fruit
<i>Depressaria daucella</i> (Den. & Schiff.)	Plochuška kmínová	Apiaceae, <i>Carum</i>	flower
<i>Grapholita delineana</i> Walker	Obaleč konopný	<i>Cannabis</i> , <i>Humulus</i>	stem, flower
<i>Helicoverpa armigera</i> (Hübner)	Černopáska bavlníková	polyphagous	flower, fruit, leaf
<i>Lacanobia oleracea</i> (Linnaeus)	Můra kapustová	polyphagous, <i>Brassica</i> , <i>Beta</i>	leaf
<i>Mamestra brassicae</i> (Linnaeus)	Můra zelná	polyphagous, <i>Brassica</i> , <i>Beta</i>	leaf, fruit
<i>Ostrinia nubilalis</i> (Hübner)	Zavíječ kukuřičný	polyphagous, <i>Zea</i> , <i>Humulus</i>	stem, fruit
<i>Pieris brassicae</i> (Linnaeus)	Bělásek zelný	Brassicaceae	leaf
<i>Pieris rapae</i> (Linnaeus)	Bělásek řepový	Brassicaceae	leaf
<i>Plutella xylostella</i> (Linnaeus)	Zápředníček polní	Brassicaceae	leaf
<i>Scrobipalpa ocellatella</i> (Boyd)	Makadlovka řepná	Amaranthaceae, <i>Beta</i>	leaf
<i>Tuta absoluta</i> (Meyrick)	Makadlovka rajčatová	Solanaceae, <i>Solanum lycopersicum</i> , greenhouses	leaf, mines

**Pests of fruit trees and grapevine** (Tab. II). This group comprises 13 species and 2 genera, 28% of all Lepidoptera pests. *Archips xylosteana* (Linnaeus), possibly *A. podana* (Scopoli) and *A. crataegana* (Hübner), respectively *Noctua pronuba* (Linnaeus) and *N. fimbriata* (Schreber) reach harmful numbers in these two genera most frequently. In contrast to the field pests, polyphagous, non-specialised

species do not make up even half of this group, and 2 of them are harmful only on the vine even when polyphagous. The species of greatest negative economic importance are the fruit-degrading species (*Cydia pomonella*, *Eupoecilia ambiguella*, *Grapholita funebrana*, *G. molesta* and *Lobesia botrana*), and only these species are continuously monitored. Species that can significantly affect the health and vitality

## II: Pests of fruit trees and grapevine

Scientific name	Czech name	Food – host plant	Part of the plant
<i>Anarsia lineatella</i> (Zeller)	Makadlovka broskvoňová	<i>Prunus</i>	young shoot
<i>Argyresthia pruniella</i> (Clerck)	Molovka pupenová	<i>Prunus</i>	bud, shoot, fruit
<i>Archips</i> spp.	Obaleč	polyphagous	leaf
<i>Cossus cossus</i> (Linnaeus)	Drvopleň obecný	polyphagous, woody plants	wood
<i>Cydia pomonella</i> (Linnaeus)	Obaleč jablečný	<i>Malus</i>	fruit
<i>Eupoecilia ambiguella</i> (Hübner)	Obaleč jednopásý	polyphagous, <i>Vitis</i>	fruit
<i>Grapholita funebrana</i> (Treitschke)	Obaleč švestkový	<i>Prunus</i>	fruit
<i>Grapholita molesta</i> (Busck)	Obaleč východní	<i>Prunus</i>	fruit
<i>Lobesia botrana</i> (Den. & Schiff.)	Obaleč mramorovaný	polyphagous, <i>Vitis</i>	fruit
<i>Noctua</i> spp.	Osenice	polyphagous	bud
<i>Pennisetia hylaeiformis</i> (Laspeyres)	Nesytky maliníková	<i>Rubus idaeus</i>	root
<i>Synanthedon myopaeformis</i> (Borkhausen)	Nesytky jabloňová	<i>Malus</i> and related genera	wood
<i>Synanthedon tipuliformis</i> (Clerck)	Nesytky rybízová	<i>Ribes</i>	wood
<i>Yponomeuta malinellus</i> Zeller	Předivka jabloňová	<i>Malus</i>	leaf
<i>Zeuzera pyrina</i> (Linnaeus)	Drvopleň hrušňový	polyphagous	wood

of infested woody plants are also important (*Cossus cossus*, *Synanthedon myopaeformis*, possibly *Zeuzera pyrina*). On the other hand, species that damage the foliage (sometimes also buds or shoots) and thus reduce the assimilative area to a greater or lesser extent are only occasional or minor pests, with large inter-annual and local variations, and do not usually require any regular control (*Anarsia lineatella*, *Argyresthia pruniella*, *Archips* spp., *Noctua* spp., *Yponomeuta malinellus*). Some polyphagous pests of ornamental foliage, such as *Euproctis chrysorrhoea* and *Hyphantria cunea*, can also damage fruit trees.

**Pests of ornamental plants** (Tab. III). Of the 7 ornamental greenery pests listed, two are broad polyphagous, one is associated with woody plants of a single family and four are narrow trophic specialists. All of them feed on foliage and cause varying reduction in the aesthetic function of ornamental trees, depending on the intensity of the infestation. Severe and repeated infestations of the boxwood by *Cydalima perspectalis* can lead to the death of the shrub or its whole large stands. Repeated infestations of trees by *Euproctis chrysorrhoea* (see also forest pests) and *Hyphantria cunea* lead to a significant reduction of their vitality and drying. Infestation by the remaining four species does not usually have a significant effect on the health of the trees. Of the pests of ornamental plants, *Cameraria ohridella*, *Cydalima perspectalis*, *Euproctis chrysorrhoea* and *Hyphantria cunea* are monitored locally and occasionally, and control measures are taken where necessary. Although the infestation of woody plants by *Scythropia crataegella*, *Yponomeuta evonymella* and *Y. cagnagella* is often very noticeable

and attracts attention, plant protection against these species is problematic in residential environments and is usually unnecessary and not carried out in ornamental greenery outside settlements (e.g. greening of roads). Some polyphagous species listed among field and garden pests (*Helicoverpa armigera*) and among pests of fruit trees (*Archips* spp., *Cossus cossus*, *Zeuzera pyrina*, *Noctua* spp.) may occasionally also damage ornamental plants.

**Forest pests** (Tab. IV). Among the Lepidoptera pests of forest trees, species that feed assimilating organs predominate significantly. Of greater negative importance are pests of conifers, because conifers cope with defoliation less well than deciduous trees. Of the species mentioned, *Lymantria dispar* and *L. monacha* are continuously monitored, both with more pronounced gradations (but smaller than in the past). The remaining species overpopulate irregularly, locally and often unexpectedly, e.g. *Panolis flammea* in the Bzenec region in southern Moravia in 2018 (cf. Liška, 2008; Lubojacký *et al.*, 2019), in somewhat larger areas and more frequently also *Coleophora laricella* (e.g. Liška, 2003). Conifer seeds are occasionally damaged by *Dioryctria abietella*. More pronounced short-term defoliation of forest trees may occasionally be caused by complex caterpillar feeding by multiple other species, none of which individually reach damaging abundance, e.g. *Archips* spp., *Pandemis* spp., *Tortrix viridana*, *Orthosia* spp., *Erannis defoliaria*, *Agriopsis* spp. and *Operophtera brumata*. In addition, some polyphages from the above groups may occasionally also damage forest trees, e.g. *Euproctis chrysorrhoea* (Lubojacký *et al.*, 2022), and *Agrotis* or *Noctua* spp. in forest nurseries.

### III: Pests of ornamental plants

Scientific name	Czech name	Food – host plant	Part of the plant
<i>Cameraria ohridella</i> Deschka & Dimić	Klíněnka jírovcová	<i>Aesculus hippocastanum</i>	leaf, mines
<i>Cydalima perspectalis</i> (Walker)	Zavíječ zimostrázový	<i>Buxus</i>	leaf
<i>Euproctis chrysorrhoea</i> (Linnaeus)	Bekyně zlatořitná	polyphagous, woody plants	leaf
<i>Hyphantria cunea</i> (Drury)	Přástevníček americký	polyphagous, woody plants	leaf
<i>Scythropia crataegella</i> (Linnaeus)	Zápředníček trnkový	Rosaceae, woody	leaf
<i>Yponomeuta evonymella</i> (Linnaeus)	Předivka zhoubná	<i>Prunus padus</i>	leaf
<i>Yponomeuta cagnagella</i> (Hübner)	Předivka brslenová	<i>Euonymus</i>	leaf

### IV: Forest pests

Scientific name	Czech name	Food – host plant	Part of the plant
<i>Coleophora laricella</i> (Hübner)	Pouzdrovníček modřínový	<i>Larix</i>	leaf
<i>Dioryctria abietella</i> (Den. & Schiff.)	Zavíječ smrkový	<i>Abies</i> , <i>Picea</i> , <i>Pinus</i> (Pinaceae)	cone
<i>Lymantria dispar</i> (Linnaeus)	Bekyně velkohlavá	polyphagous, woody plants, <i>Quercus</i>	leaf
<i>Lymantria monacha</i> (Linnaeus)	Bekyně mniška	polyphagous, <i>Picea</i> , <i>Pinus</i>	leaf
<i>Panolis flammea</i> (Den. & Schiff.)	Můra sosnokaz	<i>Pinus</i>	leaf
<i>Rhyacionia buoliana</i> (Den. & Schiff.)	Obaleč prýtoý	<i>Pinus</i>	bud, shoot

## V: Storage pests

Scientific name	Czech name	Food
<i>Ephestia elutella</i> (Hübner)	Zavíječ skladištní	various dry foods of plant origin
<i>Ephestia kuehniella</i> Zeller	Zavíječ moučný	flour and flour products, etc.
<i>Galleria mellonella</i> (Linnaeus)	Zavíječ voskový	bee hives
<i>Nemapogon granella</i> (Linnaeus)	Mol obilní	various dry foods, mushrooms, etc.
<i>Niditinea fuscella</i> (Linnaeus)	Mol	leather, fur, feathers, etc.
<i>Plodia interpunctella</i> (Hübner)	Zavíječ paprikový	various dry foods and other materials
<i>Sitotroga cerealella</i> (Olivier)	Makadlovka obilná	cereals and other seeds, dry plants
<i>Tinea pellionella</i> (Linnaeus)	Mol kožíšinový	fur, feathers, wool, carpets, etc.
<i>Tineola bisselliella</i> (Hummel)	Mol šatní	leather, fur, feathers, wool, etc.

Compared to the other cultures mentioned above, forests are much closer to natural ecosystems with more or less functioning autoregulatory mechanisms. Thus, control interventions against harmful species can negatively affect the entire complex of “non-target” species, which are essential in the forest ecosystem functioning (decomposers and the entire edaphone, bioregulators, pollinators, and biodiversity as a whole). Therefore, these interventions (whether using chemicals or *Bacillus thuringiensis*-based products) are acceptable only in extreme situations and only if the pest has clearly greater negative impacts on the forest ecosystem than any intervention against it.

**Storage pests** (Tab. V). Of the larger number of „warehouse“ moths (about 35 species), only a relatively limited number can be considered true pests. They can cause economically significant damage in food industry, warehouses of food, other products and various organic materials. In households, their numbers are usually controlled by simple cleaning and they are considered to be undesirable and nuisance species, usually not causing economically significant damage. Most of them are widely polyphagous mainly on plant products, but a few have a strong preference for animal materials (*Niditinea fuscella*, *Tinea pellionella*, *Tineola bisselliella*); *Galleria mellonella* inhabits bee hives. More than half of these species permanently inhabit the interior of buildings, they can only live outdoors for short periods of time. Of these, only *Galleria mellonella* (flying out of hives), *Nemapogon granella*, *Niditinea fuscella* and *Tinea pellionella* are also commonly found in the outdoor environment. Currently the most important are *Plodia interpunctella*, possibly *Nemapogon granella* and *Sitotroga cerealella*. Conversely, for example, the abundance and importance of the formerly common *Ephestia kuehniella* has clearly declined in the last two decades.

## DISCUSSION

In Czechia, the proportion of really harmful Lepidoptera is about 1.4% of the total number of species – about 3550 Lepidoptera species are known so far (Laštůvka and Liška 2011 and later records). In the wider area of the whole Central Europe, the number of pests is only slightly higher, but with a significantly higher total number of species, which reduces the proportion of harmful species to about 1.1% (almost 5000 Lepidoptera species are known in Central Europe – see e.g. Šumpich *et al.*, 2022b). Only a few species that are not important as pests in Czechia are harmful in other parts of Central Europe, e.g. some species associated with lowland pine stands in northern parts of Central Europe, such as *Dendrolimus pini* (Linnaeus).

The species composition of pests and the importance of individual species change to some extent over time. Changes in pest pressure can be caused by changes in agrotechnology, the introduction of new crops (each new crop means new pests), new approaches to plant protection, changes in pest properties and requirements, and global climate change. For example, *Ostrinia nubilalis* has become more damaging in recent decades with increased maize acreage and no-till cultivation processes. The reasons for the abundance increase and harmfulness of *Helicoverpa armigera* are less clear, perhaps due to the properties of the species itself. It was first registered in Czechia in 1964 (Starý, 1965), and sometimes reaches harmful numbers since the 1990s. The importance of *Grapholita delineana* may increase with the extent of cultivation of industrial hemp (cf. Seidenglanz, 2011). Repeated movements of *Hyphantria cunea* in the order of tens of kilometres northwards (and back) and changes in abundance are probably dependent on multi-year warm periods. Higher temperatures may allow the development of more generations of some species (*Agrotis segetum*, *Cydia pomonella*, *Pieris brassicae*), which, although it may lead to greater short-term harm, may be more detrimental to the species concerned, as the

offspring of the supernumerary generation often fail to reach the developmental stage necessary for overwintering. More frequent warm winters have a negative effect on most insects, including pests, with exceptions such as some migrants that survive winter more easily in Central Europe (*Autographa gamma*). Fluctuations in the harmfulness of many pest species may be due to their long-term population dynamics and the current weather.

Insect abundance has generally been declining in recent decades, and this is also true for many pests (although these are usually somewhat less affected by this decline due to their ecological tolerance). Many species listed as minor pests decades ago have become unimportant, e.g. *Eriogaster lanestris* (Linnaeus) and *Xylena exsoleta* (Linnaeus), or *Sphinx pinastri* (Linnaeus) in forestry. Also some formerly important pests with repeated gradations have lost importance in recent decades, e.g. *Tortrix viridana* (Linnaeus), *Operophtera brumata* (Linnaeus), *Erannis defoliaria* (Clerck), *Malacosoma neustria* (Linnaeus), *Dendrolimus pini* (Linnaeus), *Calliteara pudibunda* (Linnaeus) or have become minor pests. Other species have caused significant damage only a few times in the past and since then have been consistently listed as pests without causing harm, see the well-known calamity of *Loxostege sticticalis* (Linnaeus) in 1921 (Rambousek, 1921). Similarly, the large-scale calamity of *Zeiraphera griseana* (Hübner) in 1977–1983 (e.g. Kalina *et al.*, 1985; Liška, 1999) can be mentioned; this species has not shown significant increases in abundance in recent decades. Conspicuous fluctuations in abundance also occur in *Aporia crataegi* (Linnaeus) with long periods of complete absence (e.g. Šefrová, 2003). The species spectrum of pests is thus narrowing over time, minor pests have often stopped damaging, the importance of many important pests significantly declined. The most pronounced narrowing of the species spectrum of damaging species is seen in forest pests, with a concomitant decline in the importance (extent of damage) caused by important pests (see e.g. Lubojacký *et al.*, 2023).

The spontaneous spread of new pest species in connection with warming is negligible for the time being, and none has been recorded among moths and butterflies. The spread of species introduced from other parts of the world (alien species) may be a somewhat greater problem, although this group is also not very numerous among Lepidoptera. Since the middle of the 20<sup>th</sup> century, 18 non-native invasive Lepidoptera species have been registered in Czechia (see e.g. Šefrová *et al.*, 2023). Of these,

4 species are currently causing non-negligible damage to plants: *Hyphantria cunea* (first recorded 1950; Miller, 1952), *Grapholita molesta* (1951; Hrdý and Krampl, 1977), *Cameraria ohridella* (1993; Laštůvka *et al.*, 1994) and *Cydalima perspectalis* (2011; Šumpich, 2011), i.e. only 2 have been added in the last 30 and one in the last 20 years. Some of the alien species have only been harmful in the short term for a few years after introduction, e.g. *Argyresthia thuiella* (Packard) after 1988 (Povolný and Zacha, 1990) or *A. trifasciata* Staudinger after 2000 (Šumpich, 2002, etc.). In addition to the invasive, further aliens are introduced that are unable to survive for long periods in the external environment and some may be harmful on plants in greenhouses (mostly in the short term until eradication). For example, the eastern Asian *Caloptilia azaleella* (Brants) was introduced into Czech greenhouses with host azaleas around 1920 (Zimmermann, 1924), subsequently not observed for about 90 years, and has been re-detected in garden centres since 2010 (Šumpich *et al.*, 2011), without detrimental abundance. Similarly, *Cacoecimorpha pronubana* (Hübner) is a minor pest, introduced into garden centres since 2008 (Šumpich *et al.*, 2009), with isolated short-term occurrences in the outdoor environment (e.g. Jakubíková *et al.*, 2016). In last decades, *Opogona sacchari* (Bojer) or *Duponchelia fovealis* Zeller have been occasionally introduced with the greenhouse and interior plants (Sitek, 2003; Liška *et al.*, 2000, etc.) and *Elophila difflualis* (Snellen) or *Parapoynx diminutalis* Snellen with aquatic plants (Laštůvka and Liška, 2011). More significant to considerable damage in greenhouses is currently caused by only two species, *Tuta absoluta* and *Chrysodeixis chalcites*, introduced repeatedly with tomato seedlings (e.g. Bártová and Marek, 2000; Březíková, 2019). Other pests of warm regions are occasionally introduced with plants or plant products and their possible harmfulness in greenhouses or even in the external environment of central Europe is difficult to predict, e.g. *Thaumatotibia leucotreta* (Meyrick) (Šumpich *et al.*, 2022a) or *Chrysodeixis eriosoma* (Doubleday) (Šumpich *et al.*, in press).

No new warehouse moth pests have been registered in recent decades. Most of these species now have cosmopolitan or near-cosmopolitan distributions, have long since been dispersed across much of the world (many historically with the spread of human civilization), and thus the potential of any introduction of additional new pests from this group is likely minimal.

## CONCLUSION

About 50 species of moths and butterflies can currently be considered pests of plants or stored materials in Czechia (1.4% of all species).

The species spectrum of pests has been narrowing over time, with minor pests losing their importance, as well as some formerly important pests.

The importance of most important pests remains more or less the same in the long term, with varying degrees of fluctuation.

In the past 30 years, 2 new (introduced) non-native pest species have been registered in Czechia and 2 more are being introduced repeatedly to greenhouses.

No new moth or butterfly pest has spread spontaneously to Czechia, e.g. due to climate change.

#### Acknowledgements

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