

The natural enemies of privets (*Ligustrum*: Oleaceae): a literature review, with particular reference to biological control

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Abstract

The arthropod and fungal natural enemies of privets (*Ligustrum* spp., Oleaceae) are listed, based on the data from taxonomic and nomenclatural websites, printed and electronic literature searches, including CAB Abstracts. Initially, the lists were compiled to identify and assess those natural enemies occurring on *Ligustrum robustum* in its indigenous Asian range as part of a classical biological control programme for the island of La Réunion, where this privet species has become a problematic invasive alien weed. However, because other species of *Ligustrum* are also posing invasive problems in other parts of the world, wherever they have been introduced, the lists have been expanded to cover all species in the genus. These records of natural enemies of *Ligustrum*, together with the distribution data, should enable those involved with the issues of invasive privets to assess the potential of classical biological control as an option for their management. As a further aid, an overview of those natural enemies considered to have the highest potential as classical biological control agents for *L. robustum* is included.

Keywords: Classical biological control, Fungi, Insects, Invasive alien weeds, Invertebrates, La Réunion, Sri Lanka, Biocontrol, *Ligustrum robustum* subsp. *walkeri*

Review Methodology: Natural enemy records were compiled separately for invertebrates (mainly insects) and fungi. For invertebrates, records were located from CAB Abstracts (records featuring '*Ligustrum*' and 'pest'), and various references documenting food plants of specific insect groups and/or authoritative accounts of particular groups (e.g. [1–9]), publications arising from the assessment of the scope for biological control of other species of *Ligustrum* [10, 11], and Internet searches. The survey of insect natural enemies of *Ligustrum sinense* Lour. in China by Zhang *et al.* [11] is included in our summary, but only those species which were confirmed to feed on *L. sinense*, as opposed to just being found on this plant. Data on the wider host range and distribution were extracted from similar sources and the Crop Protection Compendium [12].

For fungi, Petrak's and Saccardo and Trotter's lists were consulted [13, 14], and updated with a search of the database of the US National Fungus Collections [15], and those of the official nomenclatural repositories for the kingdom Fungi: *Index Fungorum* (www.indexfungorum.org) and MycoBank (www.mycobank.org/), as well as herbaria in the UK and Sri Lanka.

The records are compiled in separate tables for arthropods and fungi. The references provided in these tables are not comprehensive, most were selected to represent the more accessible or relevant publications. Nomenclature and classification have been updated: plants based on The Plant List [16], arthropods from a variety of hard copy and Internet sources including those mentioned above and Rider [17], Beccaloni *et al.* [18], Gilligan *et al.* [19], Nuss *et al.* [20], and Poole [21] and fungi according to the *Dictionary of the Fungi* [22], *Index Fungorum* and MycoBank.

Introduction

The present review was generated originally as a background search to assess the natural enemies occurring on *Ligustrum robustum* subsp. *walkeri* (Decne.) P.S. Green

(Oleaceae) in its Asian centre of origin, as part of a classical biological control programme for the island of La Réunion, where this privet has become a problematic invasive alien species [23, 24]. Subsequently, the search was expanded to include all species of the genus *Ligustrum*, with particular

emphasis on those that are invasive aliens in other parts of the world. We feel that this unpublished research and the data generated need to be placed in the public domain as a guide for ecologists, biocontrol practitioners and stakeholders who may be involved in future decision-making on the options available for the management of invasive alien privets.

Species of the genus *Ligustrum* – with a predominantly Eurasian origin [25] – have been moved around the world as ornamental plants, especially for hedging purposes, since the mid-1800s [26]. However, several of these privet species have since become invasive in their exotic locations and, in particular, are now posing a threat to native ecosystems from the Mascarenes to Australia and New Zealand in the Old World, as well as to those in the New World, notably in Argentina, Brazil and the USA [27–36]. In addition, several of these invasive *Ligustrum* species are also classified as poisonous plants, and have been implicated in allergies such as hay fever and asthma [37, 38].

Classical biological control offers an economic, environmentally benign and long-term solution for the management of invasive alien weeds. Successful programmes have been conducted against many problematic exotic weeds, including woody species, using both arthropod and fungal natural enemies [39–41], but, thus far, never against species of the genus *Ligustrum*. The first step in any programme involves literature and database searches for natural enemies: typically, for those arthropods and fungi that have been recorded from the centre of origin or diversity of the target plant species, based on the premise that these may be coevolved natural enemies and, therefore, with a high degree of specificity to their plant host. This is followed by surveys in the plant's natural range to collect and identify natural enemies and then to assess their potential as classical biological control agents, factoring in field observations of host impact and specificity, as well as on preliminary evaluations of their compatibility with screening procedures, such as ease of handling and breeding or culturing issues. On this basis, many of the natural enemies are eliminated and a short list is drawn up of potential agents to undergo the protracted process of screening to determine their specificity and efficacy. The natural enemies of *L. robustum* (Roxb.) Blume were assessed using these parameters and further studies were concentrated on several potential insect agents [24, 42], and the leaf-feeding uraniid *Epiplema albida* Hampson was considered safe for introduction to La Réunion [43, 44].

***Ligustrum robustum* and its Phylogeny**

The genus *Ligustrum* is placed in the family Oleaceae of the Lamiales, which includes 24 other families of which Acanthaceae, Bignoniaceae, Orobanchaceae, Plantaginaceae, Scrophulariaceae and Verbenaceae are amongst the better known [45]. *Ligustrum* comprises around 40 species and is indigenous throughout most of

the temperate and tropical Old World except Africa and the coldest regions [25], and introduced elsewhere. Recent molecular studies have revealed that *Ligustrum* and *Syringa* (lilacs) are closely related and are treated as the subtribe Ligustrinae within the tribe Oleaeae [46].

Ligustrum robustum subsp. *walkeri* was originally described as a valid species, but has also been treated as a variety of *L. robustum*, and is currently accepted as a subspecies [16, 47, 48]. The indigenous distribution of *L. robustum* is restricted to India, Sri Lanka and Bangladesh to Vietnam. Within this range, subspecies *robustum* was described from Bangladesh (Silhet) and is found from northeast India to Thailand and Vietnam [48]. Subspecies *walkeri* was thought to occur in southern India ('Kerala and Tamil Nadu in the Western Ghats, especially the Nilgiri and Palni Hills, at altitudes up to 1500 m') and Sri Lanka ('Central, Sabaragamuwa and Uva Provinces, in montane regions at altitudes between 450 and 2000 m') [25, 47], but Green [48, 49] now treats the southern Indian populations as a separate species, *Ligustrum perrottetii* A.DC. *Ligustrum robustum* is no longer considered to occur in China and the taxon *L. robustum* subsp. *chinense* from southern China [50] is now considered to be a synonym of *Ligustrum expansum* Rehder [51].

In the Mascarene Islands, *L. robustum* subsp. *walkeri* appeared first in Mauritius where it was introduced around the turn of the nineteenth century [52, 53]. It now forms dense, impenetrable thickets, and its presence has been correlated with the inability of native vegetation to re-establish following disturbance [27, 54]. *Ligustrum robustum* subsp. *walkeri* arrived in La Réunion in 1969, becoming invasive in the forests of the island where it is still spreading [55].

Initially, precise information about the geographic origin of the introduced *L. robustum* in the Mascarene Islands was lacking, in part because *Ligustrum* is a taxonomically difficult genus. Molecular techniques were utilized alongside traditional techniques and historical research to elucidate the taxonomy and the exact area of origin of the introduced *Ligustrum* [56, 57]. Dried leaf samples were collected during natural enemy surveys and native material of *L. robustum* subsp. *walkeri* from Sri Lanka, *L. robustum* subsp. *robustum* from north eastern India (Assam and Meghalaya) and the closely related *L. perrottetii* from southern India (the Western Ghats) were compared with introduced material from La Réunion and Mauritius using chloroplast RFLP markers and RAPDs. Sri Lankan and introduced material was monomorphic for the same chloroplast DNA haplotype that was absent from south and north-east Indian *Ligustrum*. This material was also clearly distinguished from Indian *Ligustrum* by RAPDs, which also indicated that *L. robustum* subsp. *walkeri* in Sri Lanka is more similar to the southern Indian *L. perrottetii* than to *L. robustum* subsp. *robustum* from north-east India. This would seem to indicate that either *L. perrottetii* should be included as a subspecies of *L. robustum*, or that subsp. *walkeri* should be treated as a separate species; however, thus far, no

taxonomic change has been made. Milne and Abbott [57] concluded that the material introduced and established on Mauritius and La Réunion is derived from the Sri Lankan *L. robustum* subsp. *walkeri*. As a result, the search for natural enemies and the studies of potential biological control agents were concentrated in Sri Lanka [24, 56, 58].

Methods

The present literature review was originally made in 1996 and was based on the literature only up until that date. More recent publications were consulted in preparing this list for publication, including some based on our subsequent research [42–44, 59, 60].

Very few natural enemy species were recorded from *L. robustum* itself in the literature survey (apart from our work). Records from other *Ligustrum* spp. were also compiled, to give insight into (1) which types of natural enemy might also be expected to occur on *L. robustum*, and (2) the patterns of natural enemy specificity documented within *Ligustrum* and related genera.

Hobbyist and insect display breeders of large Lepidoptera such as silk moths (Saturniidae) use privet as a substitute food plant for many species in captivity, as it remains in leaf throughout the winter. This seems to account for all records of this family feeding on *Ligustrum* sp. (p). (original sources and [61]), apart from some species feeding on introduced privets in the Americas.

The degree of host specificity required for a weed biological control agent depends on the target area, and its indigenous and economic plants. In the case of La Réunion, there are no indigenous *Ligustrum* spp. or *Syringa* spp. *Noronhia broomeana* Horne ex Oliv. is the only endemic species of Oleaceae and is a key test plant species. Other key test plants include *Noronhia emarginata* (Lam.) Thouars (a Madagascan native naturalized in Mauritius and La Réunion), *Olea europaea* subsp. *africana* (Mill.) P.S. Green and *Olea lancea* Lam. (Mascarene endemics), although subsp. *africana* may no longer be recognized, and *O. lancea* may prove to be a synonym of the widespread *Olea capensis* L. [43]. In addition, olives (*Olea* spp.) are cultivated and ornamentals grown there include *Ligustrum ovalifolium* Hassk. and *Jasminum* spp. Hence natural enemy species only recorded from *Ligustrum* spp. or genera only recorded from Oleaceae are likely to reflect oligophagous or monophagous species worth investigating for host specificity (we treat monophagous as restricted to *Ligustrum* spp., oligophagous as restricted to Oleaceae and polyphagous as having a wider host beyond Oleaceae).

Results

The results are presented in two tables: Table 1 for invertebrates and Table 2 for fungi. Since the recent dawn of the molecular era, mycology has undergone a radical

change and fungal systematics has become a dynamic and ever changing discipline [62]. Most significantly, it has now become possible to confirm, or to link for the first time, asexual (anamorph) and sexual (teleomorph) stages using DNA sequencing. Previously, because of the morphological and phenological differences between asexual and sexual reproduction, and the rarity in or absence from the life cycle of one of these morphs, separate names were assigned to these stages – the dual system of fungal nomenclature – even when the associations were suspected or known: proven by obtaining asexual cultures from the sexual spores in the Ascomycota; or by plant inoculation in the biotrophic (non-culturable) rust fungi of the Basidiomycota. However, recent changes to Article 59 of the International Code of Nomenclature – which originally allowed for the naming of both asexual and sexual states of the fungi with unique Latin binomials – now ensures that the scientific name should be based on the principle of priority in the ‘one fungus-one name policy’ [62, 63]. This is reflected in Table 2 where, in some cases, both the old and new genus or species names are included when name priority has yet to be determined. In fact, disparity still exists between the various fungal databases concerning nomenclature and systematics. In addition, for some of the species listed – especially, those recorded during the nineteenth century – the taxonomy has not been ‘tested’ and the validity of many of the names needs to be verified. For this reason, dubious taxonomic records, as well as those records of generalist saprophytic fungi with a wide ‘host’ (substrate) range, have been omitted from the list (Table 2).

Discussion

When this literature survey of the natural enemies of *Ligustrum* spp. was first compiled in 1996 (R.H. Shaw unpublished), 73 invertebrates and 105 fungi were listed. Here, we list 213 invertebrates and 109 fungi, an increase of 192 and 4%, respectively. We suggest this difference in invertebrate numbers is due to a combination of newly published knowledge, greater accessibility of older information via the Internet, and for some groups such as Lepidoptera, a more comprehensive literature search. The difference for fungi is net of these factors and a more rigorous exclusion of species that are unlikely to be primary pathogens. These differences are a clear indication of the need for caution when making quantitative and qualitative comparisons between natural enemy lists for biological control targets compiled from the literature in different ways and at different dates.

Fungi

In the case of the fungal natural enemies of *L. robustum*, the majority of fungi collected from the centre of origin – mainly comprising necrotrophic species of the Ascomycota

Table 1 Phytophagous invertebrate natural enemies recorded from *Ligustrum* spp. in the literature

Classification species	Host plant (s)	Feeding style	Location	References
ACARI Eriophyiidae				
<i>Aculus ligustri</i> (Keifer) (= <i>Phyllocoptes ligustri</i>)	<i>Ligustrum</i> sp(p).	Leaf cell sap sucker	W Palaearctic, USA	[8]
<i>Aceria ligustri</i> (Keifer) (= <i>Eriophyes ligustri</i>)	<i>Ligustrum</i> sp(p).	Bud and leaf cell sap sucker	SE Europe, California	[8]
Tenuipalpidae				
<i>Brevipalpus obovatus</i> (Donnadieu)	Highly polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	Cosmopolitan	[8]
COLEOPTERA Chrysomelidae				
<i>Argopistes tsekooni</i> Chen	Oleaceae including <i>Ligustrum</i> spp.	Leaf miner and feeder	China	[11, 64–66]
<i>Argopistes biplagiatus</i> Motschulsky	Oleaceae including <i>Fraxinus</i> , <i>Osmanthus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p).	Larval leaf miner and adult leaf feeder	Japan	[67]
<i>Argopistes coccinelliformis</i> Csiki	Oleaceae including <i>Osmanthus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p).	Larval leaf miner and adult leaf feeder	Japan	[68]
<i>Dermorhysis lewisi</i> Jacoby	<i>Ligustrum robustum</i>	Larval root feeder and adult leaf edge feeder	Sri Lanka	[59, 69]
<i>Dermorhysis ornatissima</i> Baly	<i>L. robustum</i>	Larval root feeder and adult leaf edge feeder	Sri Lanka	[59, 69]
<i>Hyphasis</i> spp. (2)	<i>L. robustum</i>	Adult leaf feeder, larva unknown	Sri Lanka	[59]
<i>Longitarsus bimaculatus?</i> Baly	Oleaceae, primarily <i>Fraxinus</i> , but also <i>Ligustrum</i> sp(p).	Root (larvae) and leaf (adults) feeder	China	[11, 70]
Curculionidae				
<i>Deporaus tigris</i> Sawada	<i>Ligustrum</i> spp.	Leaf roller	Japan	[71]
<i>Euwallacea fornicatus</i> (Eichhoff)	Polyphagous pest of trees and bushes	Stem borer	Widespread invasive pest in tropics	[12, 59]
<i>Lepropus immunis</i> (Walker)	Polyphagous on trees of at least four families	Adult leaf feeder	Sri Lanka	[59]
<i>Lignyodes enucleator</i> (Panzer)	Oleaceae including <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p).	Presumed leaf feeder	Turkey and Poland	[72]
<i>Ochyronmera ligustri</i> Warner	<i>Ligustrum</i> , <i>Syringa</i> sp(p).	Leaf feeder	E Asia, introduced in the USA	[73, 74]
<i>Otiorhynchus aurifer</i> Boheman	Polyphagous including <i>Ligustrum</i> sp(p).	Larval root feeder, adult leaf feeder	Europe	[75]
<i>Otiorhynchus crataegi</i> Germar	Polyphagous including <i>Ligustrum</i> sp(p).	Larval root feeder, adult leaf feeder	Europe	[76, 77]
<i>Otiorhynchus meridionalis</i> Gyllenhal	Polyphagous including <i>Ligustrum</i> sp(p).	Larval root feeder, adult leaf feeder	Europe, introduced in N America	[78]
<i>Otiorhynchus rotundatus</i> Siebold	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Poland	[79, 80]
<i>Otiorhynchus smreczynskii</i> Cmoluch	Polyphagous including <i>Ligustrum</i> sp(p).	Larval root feeder, adult leaf feeder	E and N Europe	[81]
<i>Pseudocneorhinus bifasciatus</i> (Roelefs)	Numerous ornamentals including <i>Ligustrum</i> sp(p).	Root feeder	Japan, introduced in the USA	[82]
<i>Xylosandrus arquatus</i> (Sampson)	Pest of camphor (<i>Cinnamomum camphora</i> , Lauraceae); <i>L. robustum</i>	Stem borer	Sri Lanka	[59]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
Meloidae				
<i>Lytta vesicatoria</i> (Linnaeus)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	West Palaearctic	[83]
Platypodidae				
<i>Megaplatypus ruciat</i> (Chapuis)	Polyphagous including <i>Ligustrum</i> sp(p).	Stem borer	South America, introduced in Italy.	[84]
DIPTERA Cecidomyiidae				
<i>Asphondylia sphaera</i> Monzen	<i>Ligustrum</i> spp and short-term alternate hosts of other families	Gall former	Japan	[85]
<i>Placochela nigripes</i> (L�w) (= <i>P. ligustri</i>)	<i>Sambucus</i> , <i>Ligustrum</i> sp(p).	Gall former	Europe	[86]
HEMIPTERA Aphididae				
<i>Aphis crinosa</i> (Paik)	<i>Ligustrum</i> spp.; also on <i>Lonicera</i> , <i>Viburnum</i> spp.	Sap sucker	Japan and Korea	[1]
<i>Aphis gossypii</i> Glover	Highly polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	Cosmopolitan	[1]
<i>Aphis spiraeicola</i> Patch	Highly polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	Cosmopolitan	[1]
<i>Aulacorthum ibotum</i> Essig & Kuwana	<i>Ligustrum</i> spp.	Sap sucker	Japan and Korea	[1]
<i>Ceratopemphigus zehntneri</i> Schouteden	<i>L. robustum</i> subsp. <i>rucia</i> and presumably another species in China	Gall inducer and sap sucker	Sri Lanka, China	[1, 60]
<i>Macrosiphum euphorbiae</i> (Thomas)	Highly polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	Cosmopolitan	[1]
<i>Prociphilus bumeliae</i> (Schrank)	Alternating between Oleaceae and <i>Abies</i>	Sap sucker	Europe	[1]
<i>Prociphilus ligustrifoliae</i> (Tseng & Tao) ¹	<i>Ligustrum</i> spp. And an unknown alternate host	Sap sucker	China, Japan	[1, 87]
<i>Prociphilus oriens</i> Mordvilko	Polyphagous including <i>Ligustrum</i> sp(p).; alternating on <i>Abies</i>	Sap sucker	India to Japan	[1]
<i>Prociphilus osmanthae</i> Essig & Kuwana	<i>Osmanthus</i> and maybe <i>Ligustrum</i> spp. as well as an unknown alternate host	Sap sucker	Japan, maybe NE India	[1]
<i>Myzus ascalonicus</i> Doncaster	Highly polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	Cosmopolitan	[1]
<i>Myzus ligustri</i> (Mosley)	<i>Ligustrum</i> spp.	Sap sucker	Europe, introduced in Nearctic	[1, 77]
<i>Myzus persicae</i> (Sulzer)	Highly polyphagous including <i>Ligustrum</i> sp(p)., alternating on <i>Prunus</i>	Sap sucker	Cosmopolitan	[1]
Aphrophoridae				
<i>Aphrophota</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Clovia bipunctata</i> (Kirby)	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
Cicadellidae				
<i>Docotettix cornutus</i> Ribaut	Pomegranate, olive and privet	Sap sucker	Turkey	[88, 89]
Coccidae				
<i>Ericerus pela</i> Chavannes	<i>Fraxinus</i> and <i>Ligustrum</i> spp.	Sap sucker	China	[90]
<i>Parlatoria oleae</i> (Colv�e)	Primarily on <i>Olea</i> sp(p), but polyphagous including on <i>Ligustrum</i> sp(p).	Sap sucker	USA, Europe and Middle East	[12, 91]
<i>Pseudaulacaspis pentagona</i> (Targioni)	Polyphagous pest including <i>Ligustrum</i> sp(p).	Sap sucker	Cosmopolitan	[11, 92]
Coreidae				
<i>Cletus punctiger</i> (Dallas)	Polyphagous pest including <i>Ligustrum</i> sp(p).	Sap sucker	China	[11, 12]
<i>Homoeocerus</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Riptortus pedestris</i> (Fabricius)	Polyphagous pest including <i>Ligustrum</i> sp(p).	Sap sucker	Sri Lanka to China	[11, 12]
Flatidae				
<i>Geisha</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Lawana</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
<i>Metcalfa pruinosa</i> (Say)	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	N Americas, introduced in S Europe, Korea	[93]
<i>Salurnis marginella</i> (Guérin-Méneville)	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	China and SE Asia	[11]
Miridae				
<i>Adelphocoris fasiaticollis</i> Reuter	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
Pentatomidae				
<i>Acrosternum impicticorne</i> (Stål)	Soyabean pest also recorded from <i>Ligustrum lucidum</i>	Sap sucker	Brazil	[94, 95]
<i>Antiteuchus tripterus</i> (Stål)	Cocoa pest also recorded from <i>L. lucidum</i>	Sap sucker	Neotropical	[95]
<i>Antestiopsis ruciate</i> (Fabricius) (= <i>A. picturata</i> (Distant))	Coffee pest also recorded from flowers of <i>L. robustum</i>	Sap sucker (on flowers)	India, Sri Lanka	[17, 59, 96]
<i>Carbula humerigera</i> (Uhler) (= <i>C. obtusangula</i> Reuter)	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Erthesina fullo</i> (Thunberg)	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	China to SE Asia	[11, 17]
<i>Eysarcoris</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Loxa deducta</i> Walker	<i>L. lucidum</i> , but must also be found on indigenous hosts	Sap sucker	Brazil	[95]
<i>Menida</i> sp. ²	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Nezara viridula</i> (Linnaeus)	Polyphagous pest including <i>Ligustrum</i> sp(p).	Sap sucker	Pantropical	[11, 95, 97]
<i>Pentatoma</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
<i>Pallantia macunaima</i> Grazia	<i>L. lucidum</i> , but must also be found on indigenous hosts	Sap sucker	Brazil	[95]
<i>Palomena angulosa</i> Motschulsky	Polyphagous pest including <i>Ligustrum</i> sp(p).	Sap sucker	Japan to SE Asia	[11, 12]
Ricaniidae				
<i>Pochazia</i> sp.	<i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
Scutelleridae				
<i>Hyperoncus</i> ³ <i>lateritius</i> Westwood	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	China	[11]
Tingidae				
<i>Leptoypha hospital</i> Drake & Poor	<i>Ligustrum</i> sp(p).	Cell sap sucker	China to W Malaysia	[98, 99]
<i>Omoplax majorcarinae</i> Guilbert	<i>Ligustrum</i> sp(p).	Cell sap sucker	Bonin Islands (Japan)	[100]
HYMENOPTERA Tenthredinidae				
<i>Macrophya pilotheca</i> Wei & Ma	<i>Ligustrum</i> spp.	Leaf feeder	China	[101]
<i>Macrophya punctumalbum</i> (Linnaeus)	<i>Ligustrum</i> , <i>Fraxinus</i> and <i>Syringa</i>	Leaf feeder	Europe, Canada, USA and Russia	[102, 103]
LEPIDOPTERA Brahmaeidae ⁴				
<i>Brahmaea certhia</i> (Fabricius)	Oleaceae: <i>L. lucidum</i> , <i>Osmanthus fragrans</i>	Leaf feeder	China, SE Russia and Korean Peninsula	[4, 10]
<i>Brahmaea hearseyi</i> White	Oleaceae: <i>Ligustrum</i> spp.	Leaf feeder	NE Himalyas to Philippines	[4, 10]
<i>Brahmaea porphyrio</i> Chu and Wang	Oleaceae including <i>Ligustrum</i> , <i>Olea</i> , <i>Osmanthus</i> , <i>Syringa</i> sp(p).	Leaf feeder	China	[10] ⁵
<i>Brahmaea wallichii</i> (Linnaeus)	Oleaceae: <i>Ligustrum</i> spp. including <i>L. robustum</i> , <i>Osmanthus</i> spp.	Leaf feeder	India to China, Taiwan and Japan	[10, 104, 105]
Cossidae				
<i>Zeuzera pyrina</i> (Linnaeus)	Polyphagous pest of fruit and other trees	Wood borer	Widespread globally	[12, 59]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
Crambidae				
<i>Anania coronata</i> (Hufnagel)	Mainly on <i>Sambucus</i> , but on other species including <i>Ligustrum</i> sp(p).	Leaf feeder	Holarctic	[5, 106]
<i>Cydalima perspectalis</i> (Walker)	Polyphagous including <i>Ligustrum sinense</i>	Leaf feeder	East Palaearctic, India; introduced in West Palaearctic where it is a pest of box (<i>Buxus</i>)	[11, 107]
<i>Palpita celsalis</i> (Walker) (= <i>P. annulata</i> (Fabricius))	<i>Ligustrum robustum</i> , <i>Chionanthus zeylandica</i> (Oleaceae)	Leaf feeder	Sri Lanka to China	[59, 108]
<i>Palpita gracilalis</i> (Hulst) ⁶	<i>Ligustrum</i> sp(p).	Leaf feeder	Nearctic	[5, 9]
<i>Palpita inusitata</i> (Butler)	<i>L. sinense</i>	Leaf feeder	China, Japan	[11]
<i>Palpita nigropunctalis</i> (Bremer) ⁷	<i>Ligustrum</i> spp.; also <i>Fraxinus</i> sp(p).	Flowers, fruit and leaves	E Asia	[10, 11, 109]
<i>Palpita quadristigmalis</i> (Guenée)	<i>Ligustrum</i> , <i>Olea</i> , <i>Osmanthus</i> sp(p).	Leaf feeder	Nearctic, southern S America	[3, 9, 110]
<i>Palpita vitrealis</i> (Rossi) (= <i>Palpita unionalis</i>)	Mostly Oleaceae, especially <i>Olea</i> , <i>Jasminum</i> sp(p)., but also <i>Ligustrum</i> sp(p).	Leaf feeder	Old World tropics	[12, 111]
<i>Pycnarmon cribrata</i> (Fabricius)	Polyphagous including <i>L. sinense</i>	Leaf feeder	S and SE Asia	[11]
Erebidae				
<i>Amata</i> sp.	<i>Ligustrum</i> sp(p). and other genera	Leaf feeder	China	[10]
<i>Aloa lactinea</i> (Cramer)	Polyphagous including <i>L. sinense</i>	Leaf feeder	India to Japan to Philippines, Sundaland	[9, 11]
<i>Arna bipunctapex</i> (Hampson)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	China	[4]
<i>Callindra similis</i> (Moore)	<i>Ligustrum</i> sp(p). and other genera	Leaf feeder	NE India to China	[10]
<i>Halysidota ruscheweghi</i> Dyar	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Southern S America	[3]
<i>Ischyja manlia</i> (Cramer)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	India to Japan and Australia	[9, 10]
<i>Lemyra phasma</i> (Leech)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	NE India to China	[9, 10]
<i>Orgyia leucostigma</i> (Smith & Abbott)	Polyphagous on trees and shrubs including <i>Ligustrum</i> sp(p).	Leaf feeder	E USA	[7, 9, 12]
<i>Pangrapta cana</i> (Leech)	<i>L. sinense</i>	Leaf feeder	China	[11]
<i>Pangrapta grisangula</i> (Hampson)	<i>L. robustum</i>	Leaf feeder	South India, Sri Lanka	[4, 59]
<i>Pangrapta obscurata</i> (Butler)	<i>Ligustrum</i> spp.	Leaf feeder	China, Japan	[10]
<i>Pangrapta perturbans</i> (Walker) (= <i>P. trimantesalis</i> (Walker))	<i>Ligustrum</i> spp.	Leaf feeder	Bangladesh to Japan	8
<i>Spilarctia subcarnea</i> (Walker)	Polyphagous including <i>L. sinense</i>	Leaf feeder	E Palaearctic	[11]
Eupterotidae				
<i>Apona ligustri</i> Mell	<i>Ligustrum japonicum</i>	Leaf feeder	China	[4]
<i>Ganisa cyanogrisea</i> Mell	<i>L. japonicum</i> , <i>L. lucidum</i>	Leaf feeder	China	[4]
<i>Palirisa cervina</i> Moore	<i>L. japonicum</i>	Leaf feeder	SE Asia	[4]
Gelechiidae				
<i>Parastega hemisigna</i> Clarke	<i>L. lucidum</i>	Leaf feeder	Argentina	[3, 112, 128]
Geometridae				
<i>Abraxas grossularia</i> (Linnaeus)	Polyphagous, a minor pest of fruit bushes, but not typically on <i>Ligustrum</i>	Leaf feeder	Europe and North America.	[4, 9, 113]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
<i>Acasis viretata</i> (Hübner)	Polyphagous including <i>Ligustrum</i> spp.	Flowers, leaves and buds	Eurasia	[10, 113]
<i>Aethalura intertexta</i> (Walker) (= <i>anticaria</i> Walker)	Polyphagous on deciduous trees and shrubs	Leaf feeder	S Canada and E USA	[7]
<i>Agaraeus parva</i> (Hedeman)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	N India to SE Russia	[10]
<i>Alsophila aescularia</i> (Denis & Schiffermüller)	Polyphagous on deciduous trees	Leaf feeder	Temperate Eurasia	[6, 9]
<i>Angerona prunaria</i> (Linnaeus)	Polyphagous on deciduous trees and shrubs	Leaf feeder	Temperate Eurasia	[6]
<i>Apeira syringaria</i> (Linnaeus)	Caprifoliaceae and Oleaceae including <i>Ligustrum</i> sp(p).	Leaf feeder	Europe	[6]
<i>Ascotis selenaria</i> (Denis & Schiffermüller)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	S Europe to Japan, Africa	[9, 10, 114]
<i>Biston marginata</i> Shiraki	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	China, Japan, Vietnam	[9, 10]
<i>Chloroclystis v-ata</i> Haworth	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Palaeartic	[6, 9]
<i>Comostola rubripunctata</i> (Warren)	<i>Ligustrum tsusimense</i>	Leaf feeder	Japan	[6]
<i>Crocallis elinguaris</i> (Linnaeus)	Polyphagous on deciduous trees and shrubs	Leaf feeder	Europe	[6]
<i>Ectropis crepuscularia</i> (Guenée)	Polyphagous on deciduous trees and shrubs	Leaf feeder	Holarctic	[7, 9, 113]
<i>Garaeus specularis</i> Moore	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	India to Japan	[6, 115]
<i>Hemistola dijuncta</i> (Walker)	<i>Ligustrum tschonoskii</i>	Leaf feeder	Japan	[6]
<i>Lycia hirtaria</i> (Clerk)	Polyphagous on deciduous trees and shrubs	Leaf feeder	Europe	[6, 9]
<i>Menophra abruptaria</i> (Thunberg)	Oleaceae including <i>Ligustrum</i> , <i>Syringa</i> sp(p)	Leaf feeder	Europe	[6]
<i>Naxa seriaria</i> (Motschulsky)	<i>Ligustrum</i> sp(p). and other genera	Leaf feeder	SE Russia, China	[6, 10, 11, 115]
<i>Ourapteryx sambucaria</i> (Linnaeus)	Polyphagous on deciduous trees and shrubs	Leaf feeder	Europe	[6]
<i>Paleacrita vernata</i> (Peck)	Polyphagous on deciduous trees and shrubs including <i>Ligustrum</i> sp(p).	Leaf feeder	E Nearctic	[7, 9]
<i>Percnia luridaria</i> (Leech)	<i>L. sinense</i>	Leaf feeder	China	[11]
<i>Perizoma impromissata</i> (Walker)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Neotropical	[3, 6]
<i>Peribatodes rhomboidaria</i> (Denis & Schiffermüller)	Polyphagous on deciduous trees	Leaf feeder	Europe	[6, 9]
<i>Phthonosema invenustaria</i> (Leech)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Far E Asia	[6]
<i>Problepsis deliaria</i> Guenée	Oleaceae including <i>L. robustum</i>	Leaf feeder	India, Sri Lanka	[59]
<i>Problepsis superans</i> (Butler)	<i>Ligustrum</i> sp(p).	Leaf feeder	Far East Asia	[10, 116]
<i>Sabulodes aegrotata</i> (Guenée) (= <i>caberata</i> auct.)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	W coastal Nearctic	[7, 9]
<i>Scopula caricaria</i> (Reutti)	Asteraceae in Europe; Zhang <i>et al.</i> 's [11] record from <i>L. sinense</i> seems unlikely	Leaf feeder	Palaeartic	[11, 117]
<i>Trichopteryx polycommata</i> (Denis et Schiffermüller)	Caprifoliaceae and Oleaceae including <i>Ligustrum</i> sp(p).	Leaf feeder	Temperate Eurasia	[6, 10]
Gracillariidae				
<i>Caloptilia cuculipennella</i> (Hübner)	Oleaceae: <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> and <i>Jasminum</i> sp(p).	Leaf miner	Palaeartic	[9, 106, 118]
<i>Caloptilia fraxinella</i> (Ely)	Oleaceae: mainly <i>Fraxinus</i> spp. but also <i>Ligustrum</i> sp(p).	Leaf miner	Nearctic	[5]
<i>Caloptilia japonica</i> (Kumata)	<i>Ligustrum</i> spp.	Leaf miner	Japan	[118]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
<i>Caloptilia syringella</i> (Fabricius)	Oleaceae: <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> and <i>Jasminum</i> sp(p).	Leaf miner	Europe, introduced Nearctic	[9, 106]
<i>Metrochroa fraxinella</i> Kumata	Oleaceae, including <i>Fraxinus</i> , <i>Ligustrum</i> s(p).	Leaf miner	Japan	[119, 120]
<i>Phyllocnistis citrella</i> Stainton	Pest of citrus (Rutaceae)	Leaf miner	Widespread and invasive in tropics	[12, 59]
<i>Phyllocnistis</i> sp.	<i>L. japonicum</i>	Leaf miner	Japan	[121]
Hepialidae				
<i>Endoclyta variegata</i> (Walker)	Polyphagous including <i>Ligustrum</i> spp.	Wood borer	Sri Lanka to Japan, Borneo and Java	[12]
<i>Endoclyta excrescens</i> (Butler)	Polyphagous including <i>L. sinense</i>	Stem borer	Far E Palaearctic	[9, 11]
Lasiocampidae				
<i>Artace obumbrata</i> Köhler	<i>Ligustrum</i> sp. (introduced)	Gregarious leaf feeder	Argentina	[3, 112]
<i>Titya proxima</i> (Burmeister)	Polyphagous including <i>Ligustrum</i> spp.	Leaf feeder	Neotropical	[3, 112]
Limacodidae				
<i>Stroter intermissa</i> (Walker)	<i>Ligustrum</i> sp(p). and probably polyphagous	Leaf feeder	Africa	[5]
Lycaenidae				
<i>Artopoetes pryri</i> (Murray)	Oleaceae including <i>Ligustrum</i> spp. and <i>Syringa</i> spp.	Presumed leaf feeder	East Asia	[4, 10]
<i>Celastrina argiolus</i> (Linnaeus)	Polyphagous including <i>Ligustrum</i> sp(p).	Flower and fruit feeder	Holarctic	[122]
<i>Laeosopsis roboris</i> (Esper)	<i>Fraxinus</i> ; <i>Ligustrum</i> sp(p) is recorded as a laboratory host.	Leaf feeder	SW Europe	[9, 123]
Noctuidae				
<i>Cerma cerintha</i> (Treitschke)	Mostly Rosaceae, but also <i>Ligustrum</i> spp.	Leaf feeder	E Nearctic	[7]
<i>Craniophora ligustri</i> (Denis and Schiffermüller)	Mainly Oleaceae <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p). but other deciduous trees recorded	Leaf feeder	Temperate Eurasia	[5, 10, 113]
<i>Craniophora malesiae</i> Holloway	Oleaceae: <i>Olea</i> , <i>Ligustrum</i> and <i>Osmanthus</i>	Leaf feeder	NE Himalaya to New Guinea	[124]
<i>Euplexia lucipara</i> (Linnaeus)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Palaearctic	[10, 125] ⁹
<i>Harrisimemna trisignata</i> (Walker)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Nearctic	[5]
<i>Polyphaenis sericata</i> (Esper)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	S Europe to W Asia	[5]
Nymphalidae				
<i>Parathyma ranga</i> (Moore)	Oleaceae including <i>Chionanthus</i> , <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Olea</i> , <i>Osmanthus</i> sp(p).	Leaf feeder	India to SE Asia	[4, 10]
Oceophoridae				
<i>Gonionota bourquiniella</i> (Köhler)	<i>Ligustrum</i> and <i>Solanum</i> sp(p).		Brazil to Argentina	[3]
Papilionidae				
<i>Papilio multicaudata</i> W.F. Kirby	Polyphagous on deciduous trees and shrubs including <i>Ligustrum</i> sp(p).	Leaf feeder	W Nearctic	[122]
<i>Papilio rutulus</i> Lucas	Polyphagous on deciduous trees and shrubs including <i>Ligustrum</i> sp(p).	Leaf feeder	California	[126]
Psychidae				
<i>Chalioides kondonis</i> Kondo	<i>Ligustrum</i> sp(p). and other genera	Leaf feeder	China, Japan	[9, 10]
<i>Eumeta minuscula</i> (Butler)	Polyphagous pest of tea	Leaf feeder	E Asia	[9, 10, 12]
<i>Eumeta variegata</i> Snellen	Polyphagous pest	Leaf feeder	SE Asia	[9–12]
<i>Oiketicus townsendi</i> Townsend	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	E Nearctic	[127]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
Pyralidae				
<i>Endotricha theonalis</i> (Walker)	<i>L. sinense</i>	Presumed leaf feeder	China, Japan	[11]
<i>Laodamia eulepidella</i> (Hampson) (= <i>Phycita eulepidella</i>)	Oleaceae including <i>Ligustrum robustum</i>	Flower bud feeder	South and south-east Asia, Australia	[20, 59]
Saturniidae				
<i>Automeris coeresus</i> (Boisduval)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Neotropical	[3, 128, 129]
<i>Automeris naranja</i> Schaus	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Neotropical	[3, 130]
<i>Eacles imperialis</i> (Drury)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Neotropical	[3, 129]
<i>Eupackardia calleta</i> (Westwood)	Typically on <i>Leucophyllum</i> (Scrophulariaceae), but also on Oleaceae including <i>Ligustrum</i> sp(p).	Leaf feeder	Central America to Southern USA	[131]
<i>Hylesia nigricans</i> (Berg)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Neotropical	[3, 129]
<i>Rothschildia jacobaeae</i> (Walker)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Neotropical	[3, 129, 132]
Sesiidae				
<i>Podosesia syringae</i> (Harris)	Oleaceae, including <i>Fraxinus</i> , <i>Syringa</i> , <i>Ligustrum</i> , <i>Olea</i> , <i>Chionanthus</i> sp(p).	Stem borer	Nearctic	[133, 134]
Sphingidae				
<i>Acherontia atropos</i> (Linnaeus)	Mainly Solanaceae but polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Europe and Africa	[9, 135]
<i>Acherontia lachesis</i> (Fabricius)	Polyphagous	Leaf feeder	S and SE Asia to New Guinea	[9, 10, 135]
<i>Acherontia styx</i> Westwood	Polyphagous, including <i>Ligustrum</i> spp. as a minor food plant	Leaf feeder	Arabia to SE Asia	[4, 9, 10, 135]
<i>Ceratomia undulosa</i> (Walker)	Oleaceae including <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Chionanthus</i> sp(p).	Leaf feeder	Eastern N America	[136]
<i>Dolbina elegans</i> A. Bang-Haas	Oleaceae including <i>Fraxinus</i> and <i>Ligustrum</i> sp(p).	Leaf feeder	Bulgaria to Iran	[135]
<i>Dolbina exacta</i> Staudinger	Oleaceae including <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p).	Leaf feeder	Far E Asia	[137]
<i>Dolbina inexacta</i> (Walker)	Oleaceae: <i>Chionanthus</i> , <i>Fraxinus</i> , <i>Ligustrum</i> (including <i>L. robustum</i>), <i>Olea</i> , <i>Osmanthus</i> , <i>Syringa</i>	Leaf feeder	Pakistan to SE Asia	[4, 137]
<i>Dolbinia tancrei</i> Staudinger	Oleaceae including <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Olea</i> , <i>Osmanthus</i> sp(p).	Leaf feeder	Far E Asia	[10, 137]
<i>Kentrochrysalis consimilis</i> Rothschild & Jordan	<i>Ligustrum obtusifolium</i>	Leaf feeder	Far E. Asia	[137]
<i>Kentrochrysalis streckeri</i> (Staudinger)	Oleaceae including <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p).	Leaf feeder	E Asia	[4, 10, 137]
<i>Manduca rustica</i> (Fabricius)	Polyphagous including <i>Ligustrum</i> spp.	Leaf feeder	Neotropical	[3, 129]
<i>Psilogamma increta</i> (Walker)	Polyphagous including <i>Ligustrum</i> spp.	Leaf feeder	S and E Asia	[9, 10, 137]
<i>Psilogamma menephron</i> (Cramer)	Polyphagous including <i>L. robustum</i> and other <i>Ligustrum</i> spp.	Leaf feeder	Indo-Australian	[4, 9–11, 138]
<i>Sphinx chersis</i> (Hübner)	Mainly Oleaceae including <i>Ligustrum</i> spp., but also Rosaceae, Salicaceae	Leaf feeder	Eastern N America	[136]
<i>Sphinx kalmiae</i> J.E. Smith	Mainly Oleaceae <i>Fraxinus</i> spp. but also including <i>Ligustrum</i> spp.	Leaf feeder	Eastern N America	[136]
<i>Sphinx ligustri</i> Linnaeus	Polyphagous including <i>Ligustrum</i> spp.	Leaf feeder	Temperate Europe to Japan	[10, 135]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
Tortricidae				
<i>Ancylis apicella</i> (Denis & Schiffermüller)	Mainly on Rhamnaceae, but polyphagous including <i>Ligustrum</i> sp(p).	Leaf tier and feeder	Europe to Russia	[2, 139]
<i>Archips compitalis</i> Razowski	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf roller; also predator of <i>E. pela</i>	China	[140]
<i>Archips podanus</i> (Scopoli)	Polyphagous pest on trees and shrubs, including <i>Ligustrum</i> sp(p).	Flower, bud and leaf feeder	Europe	[12, 141]
<i>Archips rosana</i> (Linnaeus)	Polyphagous on trees and shrubs, including <i>Ligustrum</i> sp(p).	Flower, bud and leaf feeder	Europe, introduced Nearctic	[9, 12, 142]
<i>Argyrotaenia fletcheriella</i> (Köhler)	Polyphagous including <i>Ligustrum</i> sp(p).		Southern S America	[3]
<i>Bonagota salubricola</i> (Meyrick) and/or <i>B. cranaodes</i> (Meyrick)	Apple pest, polyphagous including <i>Ligustrum</i> sp(p).	Flower, fruit and leaf feeder	South America	[3, 143, 144]
<i>Choristoneura longicellanus</i> (Walsingham)	Polyphagous on trees and shrubs, including <i>Ligustrum</i> sp(p).		Far E. Asia	[2, 9]
<i>Clarkeulia bourquini</i> (Clarke)	Polyphagous including <i>Ligustrum</i> sp(p).	Flower, fruit and leaf feeder	Brazil to Argentina	[2, 3, 143, 145]
<i>Cryptoptila immersana</i> (Walker)	Polyphagous including <i>Ligustrum</i> sp(p).		Australia	[2, 9]
<i>Ditula angustiorana</i> (Haworth)	Polyphagous on trees and shrubs, including <i>Ligustrum</i> sp(p).	Flower, fruit and leaf feeder	Europe	[2]
<i>Epiphyas postvittana</i> (Walker)	Polyphagous pest, including <i>Ligustrum</i> sp(p).	Fruit and leaf feeder	Australia; introduced Pacific, UK	[4, 9, 12, 146]
<i>Eupoecilia ambiguella</i> (Hübner)	Polyphagous on trees and shrubs	Fruit feeder	Europe and Russia	[9, 146]
<i>Exapate congelatella</i> (Clerck)	Polyphagous on trees and shrubs, including <i>Ligustrum</i> sp(p).	Leaf tier and feeder	Europe to China	[9, 146]
<i>Clepsis consimilana</i> (Hübner)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf tier and feeder, mainly on old or dead leaves	Palaeartic; introduced USA and Madagascar	[146, 147]
<i>Homona magnanima</i> Diakonoff	Polyphagous pest, especially on tea	Leaf tier and feeder	E Asia	[9, 10, 12]
<i>Lobesia botrana</i> (Denis and Schiffermüller)	Polyphagous pest, including <i>Ligustrum vulgare</i>	Flower and fruit feeder	Palaeartic	[9, 12, 139]
<i>Lozotaenia forsterana</i> (Fabricius)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf tier and feeder	Europe to Siberia	[9, 10, 146]
<i>Pandemis heparana</i> (Denis & Schiffermüller)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf tier and feeder	Palaeartic	[2, 9, 148]
<i>Minutargyrotoza calvicaput</i> (Walsingham)	<i>L. tschonokii</i>	Leaf tier and feeder	Japan	[148]
<i>Pseudargyrotoza conwagana</i> (Fabricius)	Oleaceae, <i>Fraxinus</i> , <i>Ligustrum</i> , <i>Syringa</i> sp(p). and Berberaceae, <i>Berberis</i> sp(p).	Flower and fruit feeder	Europe to China	[10, 146]
<i>Rhopobota naevana</i> (Hübner)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf tier and feeder	Palaeartic, South Asia	[2, 59, 149]
<i>Syricoris lacunana</i> (Denis & Schiffermueller)	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf, flower tier and feeder	Palaeartic	[139]
Uraniidae				
<i>Epiplema albida</i> (Hampson)	<i>Ligustrum robustum</i>	Leaf feeder	Southern India, Sri Lanka	[43, 44, 59]
Yponomeutidae				
<i>Prays oleae</i> (Bernhard)	Olive pest also known from <i>Ligustrum</i> sp(p).	Leaf and fruit feeder	Mediterranean	[12]

Table 1 (Continued)

Classification species	Host plant (s)	Feeding style	Location	References
<i>Zelleria japonicella</i> Moriuti ORTHOPTERA Tettigoniidae	<i>L. tschonoskii</i> , <i>Syringa persica</i>		Japan	[150]
<i>Leptophyes punctatissima</i> (Bosc) THYSANOPTERA Thripidae	Polyphagous including <i>Ligustrum</i> sp(p).	Leaf feeder	Europe	[151, 152]
<i>Dendrothrips ornatus</i> (Jablonowski)	Polyphagous including <i>Ligustrum</i> sp(p).	Sap sucker	Europe, introduced in N America and China	[153, 154]
NEMATODA Heteroderidae				
<i>Cactodera cacti</i> Filipjev & Schuurmans Stekhoven	Mainly Cactaceae, but recorded from <i>Ligustrum</i> sp(p).	Root feeder	Cosmopolitan	[12, 155]
<i>Heterodera cyperi</i> Golden, Rau & Cobb	Mainly grasses and sedges, but recorded from <i>Ligustrum</i> sp(p).	Root feeder	Pantropical	[156]

¹This may be a synonym of *P. osmanthae*.

²A genus in need of revision [17].

³*Hyperoncus* Stål, 1871 appears to be an unavailable homonym of *Hyperoncus* Hesse, 1867 (see [17], <http://www.marinespecies.org/aphia.php?p=taxdetails&id=849211>).

⁴Zhang et al. [11] record *Brahmaea ledereri* Rogenhofer as a leaf feeder on *L. sinense* in China, but this species is restricted to Turkey [157].

⁵Also <http://juzhai.com/index.php/research/animal/3157-brahmaea-porphyrto-chu-et-wang.html> – how to cite?.

⁶This is an unavailable homonym, but there is no replacement name available yet.

⁷Many misidentifications in literature: <http://globiz.pyraloidea.org/>.

⁸http://www.jpmoth.org/~dmoth/80_Noctuidae/09Catocalinae/4343_Pangrapta_perturbans/Pangrapta%20perturbans.htm.

⁹This record from India may be a misidentification.

(see Table 2) – had a restricted occurrence and a limited impact on the host *in situ*, and/or proved to be difficult to manipulate in the initial host-range screening. This was the problem with *Theadgonia ligustrina* (Boerema) B. Sutton, which was identified from literature searches as the fungal species with the most potential, in terms of host impact and specificity (see Table 2, Figure 1). The latter illustrates that this pathogen can be highly damaging under natural conditions on indigenous *Ligustrum vulgare* L. in the UK, but this was never seen in the field in Asia on *L. robustum* [24]. Thus, for the long-term screening studies, none of the fungal pathogens were considered to warrant inclusion and, as detailed above, only insects were evaluated further. However, several years after the biological control programme had closed down, without the release of any agents, a disease outbreak on *L. robustum* subsp. *walkeri* in La Réunion was reported, causing severe defoliation at a number of sites on the island, with no apparent symptoms on the hedges of *L. ovalifolium* and *L. sinense* in a nearby village (C. Lavergne, pers. com., 25/09/2003). Specimens subsequently received at CABI were identified as *T. ligustrina*, with severe leaf damage and abundant sporulation. How the fungus reached the island remains a mystery, as is the absence of infection on other *Ligustrum* species, since records show that it has a wide host range within the genus (Table 2). This would suggest that host-specific pathotypes of the pathogen may occur. Unfortunately, further reports on the impact of the fungus on the invasive *L. robustum* subsp. *walkeri*, and its host range on ornamental privets, are not available. Phylogenetically, this is an extremely interesting fungus because, although its morphology superficially resembles the cercosporoid fungi – leading it to be placed in the Mycosphaerellaceae of the Dothideales (now Capnodiales [237], see Table 2) – DNA sequence analysis has now revealed that it belongs to a completely unrelated and unknown family (*incertae sedis*) within the Heliales [233]. From the field evidence in the UK and La Réunion, it is also a highly damaging pathogen and, therefore, should be a priority agent for classical biological control of invasive alien privets.

A further analysis of Table 2 shows that there is an interesting complex of rust species associated with the genus, especially in eastern Asia. Disappointingly, and strangely, no rusts have been reported in the literature, or were recorded during the surveys, on *L. robustum* in western Asia. Conversely, in both China and Japan, *Puccinia klugkistiana* (Dietel) Jing X. Ji & Kakish has been reported from some of the other problematic invasive alien privets (*L. lucidum* W.T. Aiton, *L. ovalifolium*, *L. sinense*), where it can cause significant host damage [162]. Traditionally, rusts have been the ‘fungal pathogens of choice’ for classical biological control programmes because of their obligatory biotrophic life style – and hence rigid host specificity – as well as their often debilitating host impact and long-distance dispersal efficiency [40]. This rust species, therefore, warrants inclusion in any future classical biological control

Table 2 List of fungi recorded from the genus *Ligustrum*

Classification ¹ species	Host	Location ²	Reference ³
Basidiomycota			
Pucciniales			
<i>Aecidium ligustri</i> F. Strauss ⁴	<i>Ligustrum vulgare</i>	Germany	[158]
<i>Aecidium ligustriicola</i> Cummins	<i>Ligustrum</i> sp.	China	[159]
<i>Caecoma ligustri</i> (Rabenh.) G. Winter	<i>L. vulgare</i>	Germany	[158]
<i>Puccinia abchazica</i> Tranzschel & Erem.	<i>L. arafa</i>	Russia	[160]
<i>Puccinia (Aecidium) klugkistiana</i> (Dietel) Jing X. Ji & Kakish. ⁵	<i>L. ibota</i> , <i>L. japonicum</i> , <i>L. lucidum</i> , <i>L. obtusifolium</i> , <i>L. ovalifolium</i> , <i>L. quithonil</i> , <i>L. sinense</i>	China, Japan	[159, 161, 162]
<i>Puccinia obtusata</i> G.H. Otth ex E. Fisch.	<i>L. obtusifolium</i>	Japan	[163]
<i>Uredo amami-ohshimaensis</i> Morim.	<i>L. ovalifolium</i>	Japan	[164]
Cantharellales			
<i>Ceratobasidium</i> sp. ⁶	<i>L. robustum</i> s.l., subsp. <i>walkeri</i>	India, Sri Lanka	[24]
Ascomycota			
Xylariales			
<i>Anthostoma bavaricum</i> Petr.	<i>L. vulgare</i>	Germany	[165]
<i>Anthostomella cavarica</i> (Petr.) P.M.D. Martin	<i>L. vulgare</i>	Austria	[166]
<i>Dendrophoma ligustrina</i> Kirschst.	<i>L. vulgare</i>	Germany	[167]
<i>Eutypa ligustri</i> Richon	<i>L. vulgare</i>	France	[168]
<i>Seiridium ceratosporum</i> (De Not.) Nag Raj	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[169]
Pleosporales			
<i>Ascochyta ligustri</i> Sacc. & Speg.	<i>L. vulgare</i>	Armenia, Italy	[170]
<i>Ascochyta ligustrina</i> Pass.	<i>L. vulgare</i>	France	[171]
<i>Coniothyrium ligustri</i> Brunaud	<i>L. ovalifolium</i> , <i>L. japonicum</i>	France, Greece	[172]
<i>Corynespora cassiicola</i> (Berk. & M.A. Curtis) C.T. Wei	<i>L. sinense</i>	USA	[173, 174]
<i>Corynespora ligustri</i> Y.L. Guo	<i>L. lucidum</i> ,	China	[175]
<i>Cucurbitaria ligustri</i> Fabre	<i>L. lucidum</i> , <i>L. vulgare</i>	France, Ukraine	[176]
<i>Epicoccum ligustri</i> Henn.	<i>L. vulgare</i>	Brazil	[177]
<i>Helminthosporium ligustri</i> Meng Zhang & T.Y. Zhang	<i>L. quihouii</i>	China	[178]
<i>Hendersonia ligustriicola</i> (Girz.) Merezko	<i>L. vulgare</i>	Ukraine	[179]
<i>Leptosphaeria</i> sp. ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Massarina ligustri</i> (G.H. Otth) Sacc.	<i>L. communis</i>	Switzerland	[172]
<i>Phaeodothis ligustri</i> Sawada	<i>L. nokoensis</i>	Taiwan	[180]
<i>Phoma lavitskii</i> Zerova	<i>L. vulgare</i>	Russia	[181]
<i>Phoma ligustrina</i> Thüm.	<i>L. japonica</i> , <i>L. ibota</i>	France, USA	[182]
<i>Phoma ligustri</i> N.F. Buchw.	<i>L. ovalifolium</i>	Farøes (Denmark)	[183]
<i>Phoma</i> sp.	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Pleospora ligustri</i> Politis	<i>L. japonicum</i>	Greece	[184]
<i>Rechingierella (Zopfia) boudieri</i> (Arnaud) D. Hawksw. ⁵	<i>L. vulgare</i>	France	[185]
Capnodiales			
<i>Asterina (Shivomyces) ligustriicola</i> Hosag. & Kamar ⁵	<i>L. travancoricum</i>	India	[186]
<i>Cercospora (Cercosporina)</i> <i>adusta</i> Heald & Wolf ⁵	<i>L. amurense</i> , <i>L. californicum</i> , <i>L. ibolium</i> , <i>L. japonicum</i> , <i>L. lucidum</i> , <i>L. ovalifolium</i>	China, Korea, USA	[187, 188]
<i>Cercospora ligustri</i> Roum.	<i>L. japonicum</i> , <i>L. obtusifolium</i> , <i>L. vulgare</i>	France, China, USA	[171]
<i>Cercospora ligustriicola</i> T.L. Tai	<i>L. lucidum</i> , <i>L. sinense</i>	China	[188]
<i>Mycosphaerella</i> sp. 1 ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	La Réunion	[24]
<i>Mycosphaerella</i> sp. 3 ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
⁵ <i>Passalora (Cercospora)</i> <i>oleacearum</i> (Chidd.) U. Braun	<i>L. japonicum</i> , <i>L. nilgherrense</i> , <i>L. robustum</i> s.l.	China, India	[24, 189, 190] ⁶
<i>Pseudocercospora ligustri</i> Deighton	<i>L. japonicum</i> , <i>L. lucidum</i> , <i>L. obtusifolium</i> , <i>L. ovalifolium</i> , <i>L. sinense</i>	Korea, USA	[191]
<i>Ramularia ligustrina</i> Maubl.	<i>Ligustrum</i> sp.	France	[192]
<i>Ramularia</i> sp. ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]

Table 2 (Continued)

Classification ¹ species	Host	Location ²	Reference ³
<i>Septoria japonica</i> Thüm.	<i>L. japonicum</i> , <i>L. lucidum</i>	China, Italy	[182]
<i>Septoria (Mycosphaerella) ligustri</i> (Desm.) J.J. Kickx ⁵	<i>L. vulgare</i>	Armenia, France, UK	[182, 193]
<i>Septoria ligustrina</i> Sacc.	<i>L. vulgare</i>	Austria	[194]
<i>Sphaerulina</i> sp. ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
Magnaporthales			
<i>Clasterosporium ligustri</i> O.J. Rich.	<i>L. vulgare</i>	France	[195]
Glomerellales			
<i>Colletotrichum aotearoa</i> B. Weir & P.R. Johnst.	<i>L. lucidum</i>	New Zealand	[196]
<i>Colletotrichum acutatatum</i> J.H. Simmonds ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Colletotrichum ligustri</i> Lobik	<i>L. vulgare</i>	Russia	[197]
<i>Glomerella (Colletotrichum gloeosporioides) cingulata</i> (Stoneman) Spauld. & H. Schrenk ⁵	<i>L. lucidum</i> , <i>L. japonicum</i> , <i>L. ovalifolium</i> , <i>L. sinense</i> , <i>L. vulgare</i>	China, Hungary, Ukraine, USA	[198, 199]
Diaporthales			
<i>Cytospora teheranica</i> Esfand.	<i>L. vulgare</i>	Iran	[200]
<i>Diaporthe ligustri</i> Allesch.	<i>L. vulgare</i>	Denmark	[171]
<i>Diaporthe ligustrina</i> Petr.	<i>L. vulgare</i>	Czech Republic	[201]
<i>Diplodina ligustri</i> Delacr.	<i>L. vulgare</i>	France	[172]
<i>Gnomonia cingulata</i> Beck	<i>L. vulgare</i>	Austria	[202]
<i>Leucostoma (Valsa) auerswaldi</i> f. <i>ligustrina</i> (Nitschke) Höhn. ⁵	<i>L. vulgare</i>	Germany	[203]
<i>Mycocryptospora (Cryptospora) anthostomoides</i> (Rehm) J. Reid & C. Booth ⁵	<i>L. vulgare</i>	Germany	[204]
<i>Phomopsis brachyceras</i> Grove	<i>L. vulgare</i>	UK	[205]
<i>Phomopsis ligustri-vulgaris</i> Petr.	<i>L. vulgare</i>	Czech Republic, USA	[206]
<i>Phomopsis</i> spp. 1 and 2 ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Schiffnerula (Questierella) pulchra</i> (Sacc.) Petr. ⁵	<i>L. vulgare</i>	Italy	[207–209]
<i>Valsa cypri</i> (Tul.) Tul. & C. Tul.	<i>L. vulgare</i>	France, Germany, Italy	[207]
Microthyriales			
<i>Cyclothea kamatii</i> T.S. Viswan. & Ananthan.	<i>L. nilgherrense</i> , <i>L. robustum</i> s.l.	India	[24, 210] ⁶
Botryosphaeriales			
<i>Asteromella (Phyllosticta) ligularicola</i> (Melnik) Vanev & Aa ^{5,7}	<i>L. obtusifolium</i>	Japan	[211]
<i>Camarosporium ligustri</i> Berl. & Destrée	<i>L. vulgare</i>	Belgium	[212]
<i>Diplodia ligustri</i> Westend.	<i>L. vulgare</i> , <i>Ligustrum</i> sp.	Belgium, China, Italy	[182]
<i>Diplodia ligustricola</i> Girz.	<i>L. vulgare</i>	Russia	[213]
<i>Fusicoccum ligustri</i> Died.	<i>L. vulgare</i>	Germany	[214]
<i>Guignardia</i> sp. ⁵	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Macrophylosticta ligustri</i> Sousa da Câmara	<i>L. vulgare</i>	Portugal	[165]
<i>Microdiplodia mamma</i> Allesch.	<i>L. vulgare</i>	Germany	[215]
<i>Microdiplodia ligustri</i> Hollós	<i>L. vulgare</i>	Hungary	[197]
<i>Microdiplodia ligustricola</i> Girz.	<i>L. vulgare</i>	Russia	[216]
<i>Phyllosticta ibotae</i> Nann.	<i>L. ibota</i>	Italy	[202]
<i>Phyllosticta ligustri</i> Sacc.	<i>L. japonicum</i> , <i>L. obtusifolium</i> , <i>L. quihoui</i> , <i>L. vulgare</i>	Armenia, China, Italy, Korea, Portugal, Ukraine	[170]
<i>Phyllosticta ligustrina</i> Sacc. & Speg.	<i>L. obtusifolium</i> , <i>L. vulgare</i>	Italy, Japan	[170]
<i>Phyllosticta ovalifolii</i> Brunaud	<i>L. ovalifolium</i>	France, USA	[195, 217]
<i>Phyllosticta thuemenii</i> Tassi	<i>L. japonicum</i>	Ukraine	[218]
<i>Phyllosticta</i> sp. ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Sphaeropsis ligustri</i> N.F. Buchw.	<i>L. ovalifolium</i>	Faerøes (Denmark)	[183]
<i>Zukaliopsis gardiniaie</i> Sawada	<i>Ligustrum</i> sp.	Taiwan	[219]
Ostropales			
<i>Schizoxylon (Stictis) ligustri</i> (Schwein.) Sherwood ⁵	<i>Ligustrum</i> sp.	USA	[220, 221]

Table 2 (Continued)

Classification ¹ species	Host	Location ²	Reference ³
Patellariales			
<i>Lecanidion clavisporum</i> (Berk. & Broome) Sacc. & D. Sacc.	<i>Ligustrum</i> sp.	UK	[215]
Meliolales			
<i>Irenopsis ligustri</i> M.S. Patil & Maham.	<i>L. nilgherrense</i>	India	[222]
<i>Meliola ligustri</i> Hosag.	<i>L. robustum</i> s.l.	India	[223]
Erysiphales			
⁵ <i>Erysiphe</i> (<i>Microsphaera</i>) <i>katumotoi</i> (U. Braun) U. Braun & S. Takam. ⁵	<i>L. obtusifolium</i> , <i>L. ovalifolium</i>	Japan	[224]
<i>Erysiphe</i> (<i>Microsphaera</i>) <i>ligustri</i> (Homma) U. Braun & S. Takam. ⁵	<i>L. obtusifolium</i> , <i>L. ovalifolium</i> , <i>L. tschonoskii</i>	Japan, Korea	[224]
Hypocreales			
<i>Tubercularia ligustri</i> Cooke	<i>Ligustrum</i> sp.	UK	[195]
Pezizales			
<i>Campomeris</i> sp. ⁶	<i>L. robustum</i> s.l.	India	[24]
<i>Coleophoma</i> sp. ⁶	<i>L. robustum</i> s.l.	India	[24]
<i>Pithya arethusa</i> Velen.	<i>L. vulgare</i>	Czech Republic	[165]
<i>Solicorynespora ligustri</i> Jian Ma & X.G. Zhang	<i>L. quihoui</i>	China	[225]
Dothideales			
<i>Dothidasteroma</i> sp. ⁶	<i>L. robustum</i> s.l.	India	[24]
<i>Pleurostromella ligustrina</i> Petr.	<i>L. vulgare</i>	Czech Republic	[226]
<i>Protothyrium</i> sp. ⁶	<i>L. robustum</i> s.l.	India	[24]
Chaetosphaeriales			
<i>Zignoella ligustrina</i> Pass.	<i>L. vulgare</i>	Italy	[172]
Helotiales			
<i>Bispora antennata</i> (<i>monilioides</i>) (Pers.) E.W. Mason ⁵	<i>Ligustrum</i> sp.	Italy	[171, 227]
<i>Durella ligustrina</i> Velen.	<i>L. vulgare</i>	Czech Republic	[165]
<i>Gloeosporium ligustri</i> Henn.	<i>L. vulgare</i>	Brazil	[177]
<i>Gloeosporium ligustrinum</i> Sacc.	<i>L. perottetii</i>	France	[182]
<i>Gloeosporium virgulatum</i> G.F. Atk.	<i>L. vulgare</i>	USA	[172]
<i>Hymenoscyphus</i> (<i>Helotium</i>) <i>ligustri</i> (Velen.) Svrček ⁵	<i>L. vulgare</i>	Czech Republic	[181, 228]
<i>Myxofusicoccum</i> <i>ligustrinum</i> Petr. ⁶	<i>L. vulgare</i>	Czech Republic	[201]
<i>Myxosporium cingulatum</i> Beck	<i>L. vulgare</i>	Austria	[197]
<i>Sclerotium ligustri</i> Sävul. & Sandu	<i>L. vulgare</i>	Romania	[229]
<i>Thedgonia ligustrina</i> (Boerema) B. Sutton	<i>L. japonicum</i> , <i>L. lucidum</i> , <i>L. obtusifolium</i> , <i>L. ovalifolium</i> , <i>L. robustum</i> subsp. <i>walkeri</i> , <i>L. vulgare</i>	Austria, Bulgaria, France, Germany, India, Iran, Japan, The Netherlands, Poland, Romania, South Korea, Sri Lanka, La Réunion, UK	[24, 230–234] ⁶
<i>Thedgonia</i> sp. 1 ⁶	<i>L. robustum</i> subsp. <i>walkeri</i>	Sri Lanka	[24]
<i>Thedgonia</i> sp. 2 ⁶	<i>L. robustum</i> s.l.	India	[24]
<i>Tympanis ligustri</i> Tul.	<i>L. japonicum</i> , <i>L. vulgare</i>	France, Germany, UK	[235]

¹Classification according to Kirk *et al.* [22].²Country records, old names updated to modern geography.³Oldest, most accessible reference cited first, and, when appropriate, followed by references updating the taxonomic status and/or new host records: in the Saccardo and Petrak references, the page number of the protologue is given for each species; similarly, for books and monographs, the page number for the protologue is given after the title.⁴Authors of fungal names standardized and abbreviated according to Kirk and Ansell [236]; *Index Fungorum* (www.indexfungorum.org).⁵Correct genus name, according to Kirk *et al.* [22]; in some cases, amended following the one fungus-one name policy [62, 63]; original genus or alternative name (asexual or sexual stage) in parentheses.⁶Unpublished records from CABI surveys in India and Sri Lanka, 1997–2000, host from India listed as *L. robustum sensu lato* (s.l.); specimens identified to genus by CABI Bioscience Biosystematics and Molecular Biology Programme, species level not determined but most considered to be undescribed taxa.⁷Taxonomic affiliation (Order) not confirmed – *incertae sedis* – genus assigned to most appropriate Order.

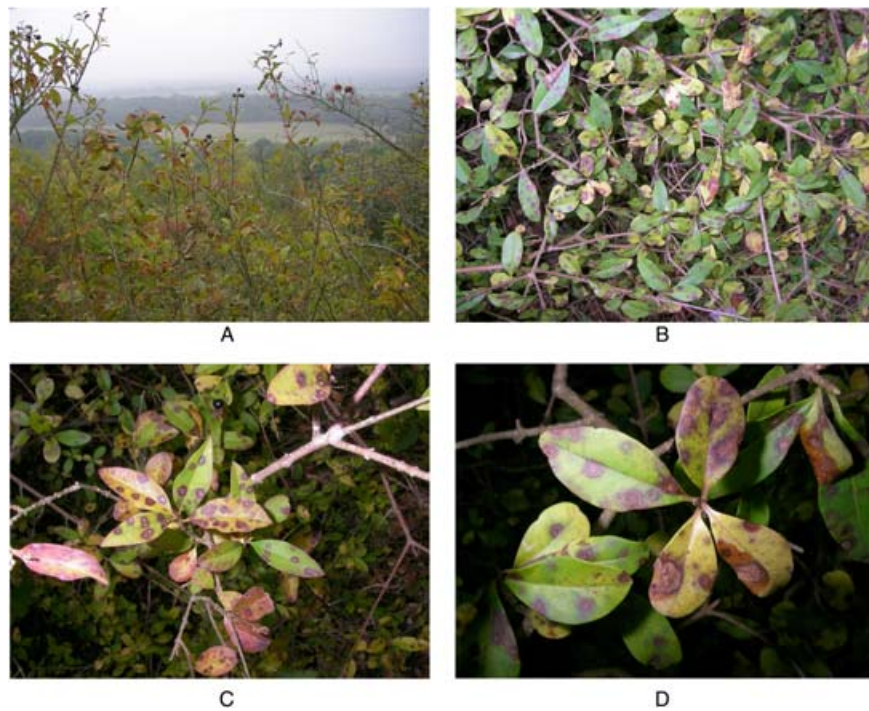


Figure 1 *Ligustrum vulgare* in natural chalk grassland habitat, North Downs, Surrey, UK. (A) Defoliated canopies of common privet along chalk ridge; (B) leaf spots of *Theadgonia ligustrina*, causing heavy damage and leading to premature leaf fall; (C–D) detail of *Theadgonia* leaf spots with characteristic tan-orange, central areas of sporulation.

Table 3 Breakdown of number of species of invertebrate natural enemy recorded to feed on *Ligustrum* sp(p). by family and specificity (summarized from Table 1)

	Monophagous (restricted to <i>Ligustrum</i> sp(p).)	Oligophagous (restricted to Oleaceae)	Polyphagous (not restricted to Oleaceae)	Not clear ¹
Acari	2		1	
Coleoptera	2	7	11	1
Diptera		1		1
Hemiptera	4	1	25	12
Hymenoptera	1	1		
Lepidoptera	20	30	88	1
Orthoptera			1	
Thysanoptera			1	
Nematoda			2	
Total	29	40	131	15

¹Includes species expected to have alternate hosts, or only identified to genus.

programme against invasive privets, such as *L. lucidum* (glossy privet) and *L. sinense* (Chinese privet).

Invertebrates

The invertebrate natural enemies of *Ligustrum* spp. found in our literature review can be divided into polyphagous (more than one family), oligophagous (restricted to Oleaceae) and monophagous (restricted to *Ligustrum* sp (p).) (Table 3), although the latter two categories may reflect lack of knowledge of other hosts rather than reality. For the purposes of classical biological control, the first category is discounted, the second category gives an indication of natural enemy genera which may contain

monophagous species, while the third category is most likely to contain species of potential biological control interest. Surveys should take the latter two groups into particular consideration. Species and genera found on surveys that have not previously been recorded from *Ligustrum* will need evaluation, based initially on literature and field observations.

Based on the results of this literature survey, we conclude that surveys for natural enemies of *L. robustum* subsp. *walkeri* in its indigenous range may find the types of oligophagous or monophagous natural enemies shown in Table 4. However, not all these types of natural enemy were found in Sri Lanka, and other potentially oligophagous or monophagous species were found that are not included in the literature-based list, reflecting that their food plants

Table 4 Comparison of the likely monophagous invertebrate groups identified from the literature survey and the filed surveys

Order: family	Likely oligophagous species or guilds based on literature review	Actual or probably oligophagous species found in surveys
Acari: Eriophyiidae	Gall-forming mites	None
Coleoptera: Chrysomelidae	Larval leaf miners such as <i>Argopistes</i> spp.	<i>Argopistes coccinelliformis</i>
Coleoptera: Chrysomelidae	None	Leaf feeders, two <i>Hyphasis</i> spp.
Coleoptera: Chrysomelidae	Larval root feeders such as <i>Longitarsus</i> spp.	Two <i>Dermorhytis</i> spp.
Diptera: Cecidomyiidae	Gall formers such as <i>Asphondylia</i> spp.	None
Hemiptera: Tingidae	Lace bug cell sap suckers such as <i>Leptoypa</i> spp.	None
Lepidoptera: Crambidae	Leaf rollers and feeders such as <i>Palpita</i> spp.	<i>Palpita celsalis</i>
Lepidoptera: Erebidae	Leaf feeders such as <i>Pangrapta</i> spp.	<i>Pangrapta grisangula</i>
Lepidoptera: Geometridae	Leaf feeders such as <i>Cosmostola</i> , <i>Hemistola</i> , <i>Problepsis</i> spp.	<i>Problepsis deliaria</i>
Lepidoptera: Gracillariidae	Leaf miners such as <i>Caloptilia</i> spp.	None
Lepidoptera: Uraniidae	None	Leaf feeder, <i>Epilema albida</i>

and biology have not previously been documented. We note that *E. albida* did not appear in the literature survey, but it is the only species for which a full host range study was completed [43]. In contrast, all the other species that were the subject of preliminary host range testing were already recognized from the literature survey (Table 4).

The records in Table 1 show that oligophagous species that feed on *Ligustrum* spp. and other Oleaceae have frequently been recorded on *Syringa* spp. as would be expected from these to genera being placed together as the Ligustrinae [46], as well as on *Fraxinus* and *Osmanthus* spp. and less often on *Olea*, *Jasminum* and *Chionanthus* spp. All these genera except *Jasminum* are placed in the subfamily Oleae: *Fraxinus* in the tribe Fraxinini is closest phylogenetically to Ligustrini, followed by *Chionanthus*, *Olea* and *Osmanthus* in the tribe Oleinae, while *Jasminum* in the subfamily Jasmineae is the least closely related. Apart from *L. robustum* subsp. *walkerii*, one species of *Olea*, two species of *Chionanthus* and five species of *Jasminum* are indigenous in Sri Lanka [48]. In addition, cultivated varieties of *Jasminum* are commonly planted. Including these genera in the field surveys for natural enemies will give a quick indication as to whether a particular species is likely to be monophagous on *Ligustrum*.

Conclusions

Very many natural enemies of *Ligustrum* species exist in the native range and amongst these are likely to be potential biological control agents worthy of further study. It is hoped that the contents of this natural enemy review will assist in adding options to the future management of these troublesome and widely introduced weeds.

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