

POTENTIAL BRITISH LEPIDOPTERAN FAUNA ON INTRODUCED *RHODODENDRON PONTICUM*

JOSÉ L. YELA

NERC Centre for Population Biology, Imperial College, Silwood Park, Ascot, England, UK
Estación Biológica de Doñana, CSIC, Apto. 1056, E-41080 Sevilla, Spain

ABSTRACT.— The potential caterpillar (Lepidoptera) fauna of the introduced woody plant *Rhododendron ponticum* (Linnaeus) was studied by foliage beating at one locality in Britain over one field season. Only a small number of larvae (n=21), corresponding to 11 species, were found on it, possibly only as incidental feeders. It is probably due to the 'recent' (in terms of geological time) introduction, connected with its taxonomic isolation and distinct chemical and physical leaf features. Two lepidopteran species may have undertaken host range expansion and seem to be using this woody plant as part of their ordinary diet (*Ditula angustiorana* (Haworth), Tortricidae; *Phlogophora meticulosa* (Linnaeus), Noctuidae).

KEYWORDS: *Acleris*, *Autographa*, *Blastobasis*, Blastobasidae, Caprifoliaceae, *Cosmia*, *Ditula*, ecology, England, Ericaceae, Fagaceae, Geometridae, herbivory, Hymenoptera, introduced plants, larvae, *Lymantria*, Lymantriidae, Mediterranean, Noctuidae, *Orthosia*, Palearctic, *Peribatodes*, *Phlogophora*, seasonality, Spain, Symphyta, Tortricidae.

Host range expansion onto alien plants is a relatively common phenomenon in insects (Strong *et al.*, 1984; Fraser and Lawton, 1994). The present paper reports observations on lepidopteran larvae feeding in Britain upon *Rhododendron ponticum* (Linnaeus) (Ericaceae), introduced from the Mediterranean region.

Rhododendron ponticum is an evergreen shrub, 2-8m high, of Mediterranean origin. The leaves show xeromorphic features, typical of a Mediterranean plant; they are coriaceous, glabrous, with a thick cuticle. A number of secondary compounds have been found in them, including polyphenols, cyanidin, delphinidin and pelargonidin (see Cross, 1975, and references therein). Bud burst tends to occur late in the season (Cross, 1975; pers. observ.). *R. ponticum* has two main shoot growth periods, one in late spring and another one between mid- and late summer. It was introduced into Britain in 1763 (Elton, 1958). It has been widely planted and thoroughly naturalised in open areas and as under-
scrub in woods (see Perring and Walters, 1976).

Being evergreen, in contrast with most of the other woody plants growing in Britain, herbivores have potentially a year-round feeding resource in *Rhododendron*. From empirical and theoretical arguments (Strong *et al.*, 1984), we might therefore expect to find a relatively species-rich insect fauna on it, its relatively high degree of taxonomic and morphological isolation notwithstanding. Furthermore, because the plant occurred naturally in Britain during some of the Pleistocene interglacials (Cross, 1975), and because it currently occurs naturally further south in Europe, there has been ample scope for some species of British phytophagous insects to encounter, and feed on, the plant prior to its introduction into Britain. Thus, insects currently found to feed on *Rhododendron* leaves in Britain may be to some extent 'pre-adapted' to do so.

Previous work on *Rhododendron* in Britain reports a poor insect herbivore fauna. Fox-Wilson (1939), Brown (1953), Elton (1958), and Cross (1975) mention between them 11 species of phytophagous insects (see also Strong *et al.*, 1984), from which only 7 are native and 4 foreign. From these 11 species, only 'a few' (Elton, 1958) are moths, mostly tortricids. Bradley *et al.* (1973) point out that the larva of *Ditula angustiorana* (Haworth) is able to feed on this plant, as is that of *Acleris comariana* (Lienig & Zeller) (both Tortricidae). Agassiz (1983) reported that a larva of *Blastobasis decolorella* (Wollaston) (Blastobasidae) was found on a dead flower head of *Rhododendron* in Glasgow, and he further observed some twigs infested with the same species (D. J. L. Agassiz, pers. comm.). I report here on the first preliminary survey of the species richness and abundance of larval Lepidoptera feeding on *Rhododendron ponticum* at a locality in southern Britain.

STUDY SITE AND METHODS

The study was carried out for only one season, from March to November 1993, at Silwood Park, Ascot, Berkshire, England. Details on the sampling site are given in Yela and Lawton (in press). *Rhododendron ponticum* is a patchily distributed and abundant shrub at the site. Caterpillars were sampled using a sampling procedure described in Yela and Herrera (1993), beating the foliage of three different plant specimens on each visit, at three height intervals. Two sampling sessions were carried out weekly (one during daytime/one during night-time). Collected larvae were either identified in situ to species, or reared to adults in petri dishes.

TABLE 1. Individual caterpillars found on *Rhododendron ponticum*. % = proportion of daily captures on *Rhododendron* against total of daily captures on a total of 11 woody plants, including *Rhododendron*, at the study site (Yela & Lawton, in press). A line divides the table in two parts, corresponding to larvae associated to each of the two main leaf flushes of the plant.

Date	Identity of specimens	Family	%
20 Apr 93	<i>Autographa jota</i> (L.)	Noctuidae	
	<i>Ditula angustiorana</i> (Haw.)	Tortricidae	4.08
25 Apr 93	<i>Ditula angustiorana</i> (Haw.)		1.64
26 Apr 93	<i>Ditula angustiorana</i> (Haw.)		1.04
2 May 93	<i>Ditula angustiorana</i> (Haw.)		0.81
12 May 93	Geometridae 1	Geometridae	0.32
19 May 93	<i>Cosmia trapezina</i> (L.)	Noctuidae	0.33
26 May 93	<i>Cosmia trapezina</i> (L.)		0.72
1 Jun 93	<i>Orthosia gothica</i> (L.)	Noctuidae	1.02
16 Jun 93	<i>Lymantria monacha</i> (L.)	Lymantriidae	
	<i>Peribatodes rhomboidaria</i> (D.& S.)	Geometridae	
	<i>Phlogophora meticulosa</i> (L.)	Noctuidae	3.75
<hr/>			
9 Aug 93	Microlepidoptera 1	?	
	Geometridae 2	Geometridae	
	<i>Phlogophora meticulosa</i> (L.)	Noctuidae	16.70
24 Aug 93	<i>Phlogophora meticulosa</i> (L.)		2.56
30 Aug 93	<i>Phlogophora meticulosa</i> (L.)		4.35
6 Sep 93	<i>Phlogophora meticulosa</i> (L.)		7.69
7 Sep 93	<i>Phlogophora meticulosa</i> (L.)		7.14
21 Sep 93	Geometridae 3	Geometridae	6.70

Plant phenology was assessed by checking almost daily 10 marked specimens. Three phenological stages were estimated visually: 'bud burst', 'full leaf expansion' and 'termination of shoot elongation'; the first two as defined by Crawley and Akhteruzzaman (1988), the last one as the moment when no evident growth of the shoot was observed (which roughly coincides with an appreciable toughening of the leaves).

RESULTS

Caterpillars were very rare: I found only 21 individuals in 68 sampling sessions (0.31 larvae per session) (Table 1), belonging to 11 species. *R. ponticum* at Silwood had two well-defined shoot growth periods, with bud burst in late April, full leaf expansion from all bushes by late May and completion of shoot elongation and the first indications of leaf toughness in late June. This was followed, in late July, by a second bud burst on most, but not all bushes; new leaves of this second flush remained tender until mid September, and were tough by the end of that month (Fig. 1). Note that, with equal sampling effort on all plant species, if caterpillars were equally abundant on *Rhododendron* as on other plants, roughly 10% of the caterpillars found would have been on *Rhododendron*, what is clearly not the case. Some or all species may be only incidental feeders, since only long-term sampling could provide a more certain conclusion. Nomenclature of Lepidoptera species follows Yela (1992) (Noctuidae) and Emmet (1991) (all other families).

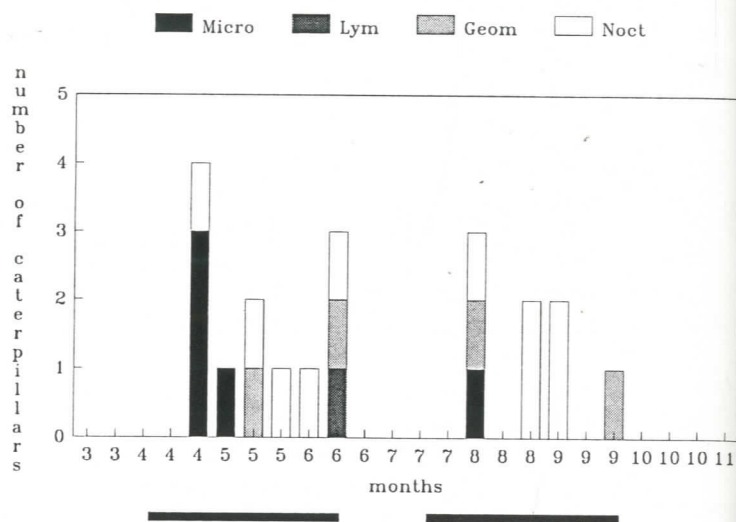


Fig. 1. Seasonal distribution of the caterpillars found on *Rhododendron ponticum*. Sampling sessions are presented in sequence; 3 refers to samples taken in March, 11 to November. Black lines at the bottom of the figure indicate the duration of the two periods in which 'new' (fresh) leaves were present on the plant in 1993. Micro = microlepidoptera; Lym = Lymantriidae; Geom = Geometridae; Noct = Noctuidae.

DISCUSSION

The total number of caterpillars collected on *R. ponticum* was extremely low. During the same period, a further 10 woody plant species were sampled with the same method and sampling intensity (Yela and Lawton, in press). Total number of larval records (including Symphyta (Hymenoptera), mainly Tenthredinoidea) from these 10 woody species during the whole sampling period was 2,752 caterpillars (40.47 larvae per session); it varied between 554 on *Quercus robur* (Fagaceae) and 76 on *Sambucus nigra* (Caprifoliaceae). Larvae collected on *Rhododendron* represent only 0.76% of the total, despite *Rhododendron* being one of the dominant plants at the site. These data support Elton's (1958) statement that there are only a few insect species associated with *R. ponticum* in Britain, none of which are very abundant.

Some species records may only refer to incidental feeding of caterpillars moving from adjacent shrubs to the *R. ponticum* shrubs. Indeed, this study may overestimate the number of Lepidoptera species that successfully and regularly exploit *Rhododendron* at Silwood. It is, thus, unclear how many of the species discovered in the survey were feeding on *Rhododendron* by chance (for instance, having fallen from other tree species), since all of them are known to consume leaves of a wide range of plant species.

A host plant range expansion was defined by Fraser and Lawton (1994) as at least two feeding records on a novel plant species, with the larva being able to complete development on the new host. Only 3 of the 11 species found on *Rhododendron* were collected at least twice, although a further 4 completed their developmental cycles under laboratory conditions (Table 1). Of the 11 species found, only *Ditula angustiorana* (Tortricidae) (4 specimens) and *Phlogophora meticulosa* (Noctuidae) (6 specimens) appear to have undergone a genuine hostplant range

expansion into *R. ponticum* in south Britain.

Every species but one appears to be univoltine, the only non-univoltine species being *Phlogophora meticulosa*. At Silwood Park, it seems to be bivoltine both on *Rhododendron* and on other plant species, as in many other European localities. Larvae of both generations were found on *Rhododendron* only when the new leaves were young.

In sum, despite being common and widespread, established in Britain for a long time, and of high 'architectural complexity'—all factors known to enhance the probability of colonization of alien plants by native insects (Strong *et al.*, 1984; Leather, 1986; Fraser and Lawton, 1994) — *Rhododendron ponticum* still has a very impoverished and rare insect fauna compared with native and other alien plants at the site, even more so if some or all of the listed larvae are only incidental feeders on this host. It seems probable that colonization of native insects is inhibited by the plant's distinctive secondary chemistry and leaf texture (Cross, 1975, and references therein) and unusual phenology (native broad-leaved evergreen understory shrubs are very scarce in the British flora).

ACKNOWLEDGMENTS

John H. Lawton carefully revised the manuscript. The following helped in the field work, identified specimens or improved the text with interesting remarks: David Agassiz, Charo Berzosa, Simon Fraser, Marcel Holyoak, John Prendergast and Karsten Schönrogge. During the preparation of this work, I was supported by a postdoctoral grant from the Royal Society of London, England, and a contract from the Ministerio de Educación y Ciencia (associated to DGICYT project PB 91-0114), Spain.

REFERENCES CITED

- Agassiz, D. J. L.**
1983. Microlepidoptera – a review of the year 1983. *Ent. Rec. J. Var.* (Bromley), 96:245-258.
- Brown, J. M. B.**
1953. *Rhododendron ponticum* in British woodlands. *Rep. For. Res.* (London), 1953:42-43.
- Crawley, M. J., and M. Akhteruzzaman**
1988. Individual variation in the phenology of oak trees and its consequences for herbivorous insects. *Funct. Ecol.* (Oxford), 2:409-415.
- Cross, J. R.**
1975. Biological flora of the British Isles. *Rhododendron ponticum*. *J. Ecol.* (Oxford), 63:345-364.
- Elton, C. S.**
1958. *The Ecology of Invasions by Animals and Plants*. London: Methuen. 482pp.
- Emmet, A. M.**
1991. Life history and habits of the British Lepidoptera. In A. M. Emmet and J. Heath (eds.), *The Moths and Butterflies of Great Britain and Ireland*. Vol. 7, Pt. 2. London: Harley Books.
- Fox-Wilson, G.**
1939. Insect pests of *Rhododendrons*: their distribution in Britain. *Proc. Roy. Ent. Soc. London*, (A) 14:1-5.
- Fraser, S. M., and J. H. Lawton**
1994. Host range expansion by British moths onto introduced conifers. *Ecol. Ent.* (Oxford), 19:127-137.
- Leather, S. R.**
1986. Insect species richness of the British Rosaceae: the importance of host range, plant architecture, age of establishment, taxonomic isolation and species-area relationships. *J. Anim. Ecol.* (Oxford), 55:841-860.
- Perring, F. H. and S. M. Walters (eds.)**
1976. *Atlas of the British Flora*. 3rd ed. East Ardsley, Wakefield: EP Publ. 441pp.
- Strong, D. R., J. H. Lawton and T. R. E. Southwood**
1984. *Insects on Plants*. Oxford: Blackwell Sci. Publ. 313pp.
- Yela, J. L.**
1992. *Los Noctuidos (Lepidoptera) de la Alcarria (España Central) y su Relación con las Principales Formaciones Vegetales de Porte Arbóreo*. Madrid: Minist. Pesca y Aliment. 569pp.
- Yela, J. L., and C. M. Herrera**
1993. Seasonality and life cycles of woody plant-feeding noctuid moths (Lepidoptera: Noctuidae) in Mediterranean habitats. *Ecol. Ent.* (Oxford), 18:259-269.
- Yela, J. L., and J. H. Lawton**
(in press). Insect herbivore loads on native and introduced plants: a preliminary study. *Ent. Exper. Appl.* (Dordrecht).