Oecologia (Berlin) (1987) 72:479–480

Oecologia

Short communication

Diverging patterns of host use by phytophagous insects in relation to leaf pubescence in *Arbutus xalapensis* (Ericaceae)

E. Ezcurra, J.C. Gómez, and J. Becerra
Instituto de Ecologia, Apdo. 18-845, 11800 Mexico, D.F.

Summary. Foliar pubescence in the mexican madrone (*Arbutus xalapensis* H.B.K.) is an extremely variable character. Leaf specimens of pilose and glabrous madrones showed a similar composition of major secondary compounds. On the other hand, sympatric pilose and glabrous individuals were found to support significantly different insect guilds. Insect preference was strongly associated to mouthpart anatomy. Chewing and gall-forming insects were significantly more abundant on glabrous trees while sucking insects were more common on pilose trees. Additionally, parasitation of sucking insects was lower on pilose trees, possibly because the plant trichomes provide protection against parasitoids.

Key words: Herbivory – Plant trichomes

The mexican madrone (*Arbutus xalapensis* H.B.K.) is an extremely variable species. In particular, foliar pubescence seems to be the most variable character, and pilose and glabrous individuals are commonly observed growing in sympatry (Standley 1924; McVaugh and Rossatti 1978; Becerra and Ezcurra 1986). In this note we report the existence of differential phytophagy between sympatric, pilose and glabrous madrones (*A. xalapensis*), and discuss the diverging preference of different insect guilds for the different morphs. The field work was carried out in Cuhuacan, near El Oro in the State of Mexico. Glabrous and pilose madrones coexist in this place (as they do, in fact, in most of their distributional area, see Becerra and Ezcurra 1986). In July 1985 we counted all the phytophagous insects that could be seen on the leaves and branches of the first 100 glabrous and 100 pilose madrones encountered within a predefined 5 ha sampling area. A sampling effort of one hour was allocated for each tree. The insects were identified to the family level.

The results are shown on Table 1, where the different families are clumped together according to their mouthpart function. A contingency-table analysis showed that all groups differ significantly in their frequencies from glabrous to pilose trees. Sucking insects have a significant preference for pilose madrones, while gall-forming and chewing insects are significantly more frequent on glabrous trees. Predators (entomophagous Neuroptera, Hemiptera and Coleoptera) are significantly more abundant on pilose individuals, possibly due to the fact that their prey is found predominantly in those trees. Additionally, sucking insects in pilose trees are significantly less attacked by parasitoids: while 41% of the aphids found on glabrous trees were parasitized, only 2.2% of those found on pilose madrones showed parasites ($P<0.001$).

Offprint requests to: E. Ezcurra

Table 1. Number of insects, divided into families, observed in 100 glabrous and 100 pilose madrones. The numbers in brackets indicate the frequency of trees in which the insects were observed

	Glabrous	Pilose
Sucking insects	167 (12)	6206 (100)
Homoptera		
Aphididae	112 (12)	3586 (95)
Aleyrodidae	–	281 (20)
Psyllidae	51 (8)	10 (6)
Membracidae	–	20 (13)
Coccidae	–	13 (3)
Cicadellidae	3 (3)	–
Hemiptera		
Miridae	–	2258 (93)
Lygaidae	–	2 (1)
Pentatomidae	1 (1)	–
Thysanoptera		
Unidentified fam.	–	36 (4)
Tissular insects	590 (95)	20 (16)
Unidentified galls	442 (78)	–
Lepidoptera		
Gracilaridae	148 (50)	20 (16)
Chewing insects	95 (47)	31 (19)
Lepidoptera		
Lasiocampidae	48 (34)	10 (10)
Geometridae	16 (12)	2 (2)
Nymphalidae	15 (11)	3 (3)
Saturnidae	11 (8)	9 (6)
Arctidae	5 (4)	–
Coleoptera		
Curculionidae	–	7 (6)
Predators	–	98 (78)
Neuroptera		
Chrysopidae	–	56 (25)
Hemiptera		
Reduviidae	–	24 (13)
Coleoptera		
Coccinelidae	–	18 (13)

Table 2. Major groups of secondary compounds in leaves of glabrous, pilose and glandular *Arbutus xalapensis*: –, no reaction; +, moderate reaction; + +, intense reaction

	Glabrous	Pilose
Flavonoids	+ +	+ +
Alkaloids	–	–
Coumarins	–	–
Cardiac glicosides	+ +	+ +
Cyanogenic glucosides	–	–
Quinones	+ +	+
Saponins	–	–
Sesquiterpene lactones	–	–
Tannins	+ +	+ +

Leaf samples from both a pilose and a glabrous tree were collected and analyzed for major groups of secondary compounds, using the qualitative methods presented in Dominguez (1973). The results are shown on Table 2. The trees are qualitatively similar in their composition of groups of secondary compounds, differing only in a slight degree in the reaction for one of the nine compound classes that were analyzed. The lack of marked differences in the concentration of secondary compounds allows us to assume tentatively that the presence of trichomes on the leaf surface is not associated with the presence of specific secondary compounds. It is very likely that the observed differences in the abundance of phytophagous insects between the two morphs are mostly due to the physical effect of trichomes.

It has been discussed that leaf trichomes protect plants from consumption by herbivores (Levin 1973; Strong et al. 1984). In the case of chewing insects, this postulate is consistent with our data. It is interesting, however, that the presence of leaf trichomes seems to attract the presence of sucking insects, possibly due to the refuge they provide against parasitism and predation (in general, sucking insects are much smaller than chewing insects). Thus, the evolutionary development of leaf trichomes can produce an increase in the consumption of tissular juices by sucking insects. Although the direct physical damage that these can inflict to a plant is in general lower than that caused by chewing insects, the biomass of sucking insects (and hence the amount of energy and nutrients that they can extract from the plant) is frequently greater (Moran and Southwood 1982). On the other hand, their effect as vectors of viruses and other plant diseases can induce important damage in the plant tissues. This may explain the existence of the polymorphism in *Arbutus xalapensis*: it could be hypothesized that the two morphs correspond to adaptive extremes maintained by the diverging preferences of the two main phytophagous insect guilds. We are at present investigating this problem. From an applied point of view, however, this means that the idea that selection for leaf pubescence can protect crops against certain insect pests (e.g. Pillemer and Tingey 1976) can vary a great deal according to the pest in question. Our *Arbutus* data shows that the incidence of aphids, for example, can increase substantially on pilose plants.

Acknowledgements. This research was financed by the Regional Program for Scientific and Technological Development (PRDCyT) of the Organization of American States, and by the Consejo National de Ciencia y Tecnologia (CONACyT), Mexico.

References

Becerra J, Ezcurra E (1986) Glandular hairs in the *Arbutus xalapensis* complex in relation to herbivory. Am J Bot 73:1427–1430

Dominguez XA (1973) Mètodos de Investigaciòn Fitoquimica. Ed Limusa, Mèxico

Levin DA (1973) The role of trichomes in plant defense. Q Rev Biol 48:3–15

McVaugh R, Rosatti T (1978) A new species of *Arbutus* (Ericaceae) from western Mexico. Contrib Univ Mich Herb 11(5):301–304

Moran VC, Southwood TRE (1982) The guild composition of arthropod communities in trees. J An Ecol 51:289–306

Pillemer EA, Tingey WM (1976) Hooked trichomes: A physical barrier to a major agricultural pest. Science 193:482–484

Standley PC (1924) Trees and shrubs of Mexico. Contr US Nat Herb 23(4):849–1312

Strong DR, Lawton JH, Southwood TRE (1984) Insects on plants. Harvard University Press, Cambridge, MS

Received December 5, 1986