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LABORATORY FEEDING TESTS ON THE DEVELOPMENT OF GYPSY MOTH LARVAE WITH REFERENCE TO PLANT TAXA AND ALLELOCHEMICALS

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ABSTRACT

The first through fifth instars of the gypsy moth were tested for development to adults on 326 species of dicotyledonous plants in laboratory feeding trials. Among accepted plants, differences in suitability were documented by measuring female pupal weights. The majority of accepted plants belong to the subclasses Dilleniidae, Hamamelidae, and Rosidae. Species of oak, maple, alder, madrone, eucalyptus, poplar, and sumac were highly suitable. Plants belonging to the Asteridae, Caryophyllidae, and Magnoliidae were mostly rejected.

Foliage type, new or old, and instar influenced host plant suitability. Larvae of various instars were able to pupate after feeding on foliage of 147 plant species. Of these, 101 were accepted by first instars. Larvae from the first through fifth instar failed to molt on foliage of 151 species. Minor feeding occurred on 67 of these species. In general, larvae accepted new foliage on evergreen species more readily than old foliage.

The results of these trials were combined with results from three previous studies to provide data on feeding responses of gypsy moth larvae on a total of 658 species, 286 genera, and 106 families of dicots. Allelochemic compositions of these plants were tabulated from available literature and compared with acceptance or rejection by gypsy moth. Plants accepted by gypsy moth generally contain tannins, but lack alkaloids, iridoid monoterpenes, sesquiterpenoids, diterpenoids, and glucosinolates.

PREFACE

This research was funded through grants from USDA Forest Service cooperative agreement no. PNW-82-336, Oregon State University Agricultural Research Foundation, and California Department of Food and Agriculture contract no. 6820.

Many individuals made this study possible. The generosity of G. Daterman in providing greenhouse space made it possible to study certain plants that would not have survived outdoors. He also provided important logistic and moral support. The sincere interest and involvement of R.V. Dowell in suggesting, selecting, and procuring plants was the reason why so many plants from California were tested. The 'gypsy moth crew' of D. Carmean, K.J. West, D.N. Kimberling, D. Belnavis helped in feeding larvae.

The interest expressed by the public was a very unusual part of this project. The notoriety of the gypsy moth resulted in many lectures to various government and civic groups. Questions following these lectures always included concerns about potential host plants. This interest was a strong stimulus to keep testing additional plant species.

Our collaboration with the Oregon Department of Agriculture Plant Division was essential, as they allowed the work to be performed under quarantine conditions. We greatly appreciate the reviews of an earlier draft by Alison Moldenke, Andy Moldenke, and Rene Feyereisen.

FOREWORD

The gypsy moth, *Lymantria dispar* (L), is a well known pest of northeastern deciduous forests and landscape horticulture. Therefore, most of the studies and available information on feeding habits of larvae are based on the flora of the eastern United States. However, as the gypsy moth is introduced into new areas, such as Oregon, Washington, and California, different plants become available as potential hosts. The repeated recovery of gypsy moth males at pheromone-baited traps in many locations between British Columbia and southern California has created a number of concerns. Among these concerns is whether larvae can not only feed but develop into viable adults on the foliage of various forest, urban landscape, and crop species.

Studies on gypsy moth larvae, host plant suitability regarding western plant species, and pest management were initiated in 1983 in the laboratory of JCM at Oregon State University (see Daterman et al. 1986, Miller et al. 1987, Miller and West 1987, Miller and Hanson in press). The principal objective of this research was to observe the feeding behavior, development, and survival of larvae on the foliage of certain trees, shrubs, and forbs-herbs grown in the Pacific states. Such information provides: (1) help in determining where to locate pheromone-baited traps; (2) an indication of plants that could be at risk of being defoliated, or contaminated, by the gypsy moth; and (3) a database for assessing host suitability for an insect that is a generalist feeder.

We hope that the information provided by this study can serve to stimulate additional research on the gypsy moth. We also hope that our study provides a database from which entomologists, growers, policy makers, and the attentive public can draw upon when they are faced with an outbreak of this particularly pernicious pest.

INTRODUCTION

In contrast to specialist herbivores, the relationships between generalist herbivores and specific allelochemics of their host plants are not well documented and by their diverse patterns in nature may be difficult to elucidate. However, the feeding preferences of larvae of the gypsy moth, *Lymantria dispar* (L.), provide an excellent system for an analysis of taxonomic patterns and allelochemic influences on a polyphagous herbivore. Previous studies on host preferences of the gypsy moth (Forbush and Fernald 1896, Mosher 1915, Kurir 1953, Janos 1961, Edwards and Fusco 1979, Doskotch et al. 1981, Barbosa et al. 1983, Barbosa and Krischik, 1987) have suggested possible relationships between allelochemics and host-plant acceptability. For instance, Kurir (1953) concluded that high concentrations of essential oils, glycosides, saponins, alkaloids, tannins, and bitter substances can weaken or kill gypsy moth larvae. Lechowicz (1983) suggested that suitable plants are characterized by precipitable (hydrolyzable) tannins and sclerophylly. In an analysis similar to the study we are presenting, Barbosa and Krischik (1987) concluded that the presence of alkaloids characterizes plants unsuitable for gypsy moth development.

In this paper we expand upon previous studies by submitting the results of our research which involved feeding foliage to first through fifth instar gypsy moths from 326 plant species representing 225 genera in 95 families of dicotyledonous angiosperms. In addition, we have synthesized results from previous feeding studies (Mosher 1915, Kurir 1953, Edwards and Fusco 1979) and compiled from the literature the allelochemic composition of tested plants. From this compilation we assessed the taxonomic distribution of acceptable and rejected host plants. Our analysis addresses two major concerns: (1) Can the host range of the gypsy moth be explained and predicted by the taxonomic distribution of allelochemics? (2) Can host selection by a polyphagous herbivore, such as the gypsy moth, be explained by the occurrence of an allelochemic common to all, or most, of the accepted plants?

METHODS and MATERIALS

Feeding Tests. Native and ornamental plant foliage was gathered in the vicinity of Corvallis, Oregon, and from container-grown greenhouse plants obtained from commercial nurseries in Oregon and California. Our tests were designed to use foliage in as near a natural condition to what the gypsy moth would encounter in the field during May and June.

New and old foliage were tested separately for plants with "evergreen" leaves. Stems or petioles were cut diagonally with a razor and placed in 6 x 50 mm culture tubes with water. Foliage was changed every other day or once a day as necessary. The foliage and three larvae were placed in 8 x 11 cm plastic food cups; filter paper was placed in the bottom of each cup and fine holes were punched in each lid to help regulate humidity. Nine to twelve larvae were tested on each plant species. Thus, twice as many larvae were tested on plant species when old and new leaves were used. Room temperature was maintained at 23 ± 2^{o}C.

Experiments began with first instars. During this stadium one of three events was recorded: (1) little or no feeding by larvae occurred, (2) feeding occurred but the larvae were unsuccessful in attaining the next instar, or (3) larvae were successful at feeding and molted to the next instar. If either of the first two events was observed for a particular plant species, freshly molted second instars (reared on artificial diet as first instars) were tested next on foliage of the same plant species. This procedure was repeated through five instars on unacceptable hosts. Pupal weights were recorded three days after pupation for those larvae surviving to pupation from the first or second instars.

Literature Synthesis. In compiling previous studies of gypsy moth host preference we emphasized reports containing results on a large sample of plant species. It was necessary to exclude certain studies from the analysis for various reasons. For instance, Forbush and Fernald (1896) is not included. They studied 477 plant species, with only 19 reported as being rejected by gypsy moth. Such a low rejection rate (and apparent polyphagy) is probably a result of using late instars, described as "fourth and fifth molt".

In addition to our data, we included results from three other major studies. Mosher (1915) and Kurir (1953) tested all instars of gypsy moth and assigned the tested plants to qualitative preference classes. Edwards and Fusco (1979) used third instars and recorded weight changes after one week. Based on plant species common to each study we established criteria for acceptance and rejection that maximized congruence between data sets.

We also employed a fairly stringent definition of acceptance. From our own data we defined acceptable plants as those on which newly hatched first instars could complete development to the pupal stage. Mosher (1915) divided his test plants into four classes (favored, favored after early instars, not particularly favored, and unfavored); it was necessary for us to define his first three classes as accepted plants and his last class as rejected plants. Kurir (1953) distinguished three classes (strongly fed upon, sporadically nibbled, and not accepted); we defined his first class as accepted and his last two classes as rejected plants. From Edwards and Fusco (1979) we defined accepted plants as those on which larvae gained more than 20 per cent weight in one week.

In assembling the data on secondary plant compounds we included only those compounds specified as occurring in the leaves. The tannin data (Bate-Smith and Metcalfe 1957, Bate-Smith 1962) include information on condensed tannins (leucoanthocyanins, or proanthocyanidins) and trihydroxy constituents (myricetin, ellagic acid, and delphinidin). We refer to trihydroxy constituents as hydrolyzable tannins, although they are not strictly synonymous. Data on condensed tannins (specifically leucoanthocyanins) were also taken from Gibbs (1974). Bate-Smith (1962) categorized plant families by presence or absence of leucoanthocyanins and trihydroxy constituents; we have used this classification to make inferences about presence of tannins where no data exist.

Alkaloid data are from Fong et al. (1972), Smith (1977) Smolenski et al. (1972, 1973, 1974a, 1974b, 1975a, 1975b, 1975c), Willaman and Schubert (1961), and Willaman and Li (1970). Data for iridoids are from Kaplan and Gottlieb (1982). Sesquiterpenoid data are from Emerenciano et al. (1985), Gibbs (1974), Heywood et al. (1977) and Penfold and Willis (1961). Diterpenoid data (Hegnauer 1962-1973) are presented only for Ericaceae and Lamiaceae. Glucosinolate and raphide data are from Gibbs (1974). Many of the allelochemics discussed in this study were chosen because they have been observed inhibiting (or stimulating) gypsy moth feeding in studies incorporating the purified compound in artificial diet (Doskotch et al. 1980a, 1980b, 1981).

We have detailed our results on host suitability and allelochemics at the generic level. Plant genera were scored as positive for a particular allelochemic if at least one species was cited as containing the compound. Several of the species for which we found allelochemical information are the same as those tested with the gypsy moth, although this was not always the case. Plant species are considered individually only where notable differences in feeding responses occurred between congeneric species. To facilitate retrieval and to conform to a standardized nomenclature, plants are arranged alphabetically by family and follow the nomenclature of Cronquist (1981), the only exception being our retention of 'Leguminosae' rather than 'Fabaceae'.

RESULTS and DISCUSSION

Larvae of the gypsy moth were fed foliage from plants belonging to 334 species in 233 genera in 98 families. The number of plants suitable for development increased as larvae molted to succeeding instars. In other words, the breadth of the diet increases as the larvae get older and larger. First instars developed to adults on 101 of these species (Table 1). Second and third instars developed to adults on 135 and 144 species, respectively. Few additional plants were suitable to fourth and fifth instars that had been unsuitable to earlier instars, 145 and 147 species, respectively.

The weight of live 2-day old pupae served as an excellent index of plant suitability (Table 2). In general, female pupal weights ranged from a high of 2000 mg to a low of 300 mg. Species of oak, maple, alder, madrone, eucalyptus, poplar, and sumac were highly suitable. Although larvae developed to adults, species of many rosaceous species were not very suitable.

Host suitablity between congeneric plants was very different for species in ten genera (Table 3). For instance, among the species of *Eucalyptus*, six provided suitable foliage for larval development while 11 were unsuitable. Although such results reduce the precision in predicting host suitability according to taxonomic relatedness, general patterns on host suitability regarding taxonomic entities are still possible (see later discussion of Appendices I and II).

Among the evergreen plants, host suitablity was influenced by foliage type. In 12 tests the foliage type affected larval survival differentially according to instar. The earliest instar accepted new leaves in nine of these tests. For instance, among the species of *Citrus*, larvae accepted new foliage in early instars and old foliage was generally not suitable. The early instars that accepted old foliage but rejected new, occurred in three of the 12 tests. For instance, on avocado, larvae only accepted old foliage. Allelochemical constituents and leaf toughness are likely factors in the differences observed between foliage types and larval acceptance.

Any instar between the first and fifth molt failed to develop on foliage from 161 species (Table 4). Although the larvae did not survive to succeeding instars, feeding did occur on the foliage of 68 of these species. Also, the larvae that eventually died differed in their ability to feed on foliage according to the plant species involved, type of foliage, and instar. Of the 68 species upon which some feeding occurred the fifth instar was the earliest instar exhibiting feeding in 27 cases.

The following section describes the response and development of the gypsy moth larvae according to the family, genus, and species of plant tested. Results for all of the feeding tests are listed alphabetically by plant genus in APPENDIX I. Allelochemical constituents in the foliage of tested plants are listed in APPENDIX II. An index to the genus and species of the test plants by common name is presented in APPENDIX III.

Acanthaceae

The only species tested was crossandra, *Crossandra infundibuliformis*. Tests were limited to observations of first and second instars. No feeding was noted and the larvae died of starvation.

Aceraceae

The species tested were vine maple, *Acer circinatum;* big-leaf maple, *A. macrophylum;* boxelder, *A. negundo;* and Norway maple, *A. platanoides*. In general the species are suitable for gypsy moth larval development to adults. First instars developed into adults on all the species. However, the pupal weights varied among the species tested. A diet of vine maple resulted in the lightest pupae. On the other hand a diet of big-leaf maple resulted in pupae weighing three times that of pupae in the vine maple tests. These data demonstrate that congeneric species may all be palatable but their relative suitability for larval development may differ.

Aizoaceae

The only species tested was trailing ice plant, *Lampranthus spectabilis*. The species was unsuitable for larval development. All first through fifth instars died and failed to molt in these tests.

Anacardiaceae

The genera tested were *Cotinus, Pistachia, Rhus,* and *Schinus*. The species were very suitable for gypsy moth larval development. First instar larvae developed into adults on all five of the species tested. Suitability among the species was relatively uniform and moderately high compared to tests involving species of other families.

Apocynaceae

The species tested were oleander, *Nerium oleander,* and periwinkle, *Vinca minor.* The species were unsuitable for larval development. First through fifth instars died in all the tests. Although fifth instars died on new oleander foliage, they did exhibit a minor amount of feeding. No feeding was observed on periwinkle.

Aquifoliaceae
The only species tested was English holly, *Ilex aquifolium*. The species was unsuitable for larval development. First through fifth instars died on old foliage of English holly; new foliage was not tested.

Araliaceae
The genera tested were *Aralia, Dizygotheca, Fatsia, Hedera,* and *Schefflera*. The species were unsuitable for larval development. First through fifth instars died in all tests involving five species in this family.

Aristolochiaceae
The only species tested was Dutchman's pipevine, *Aristolochia californica*. The species was unsuitable for larval development. First through fifth instars died in all tests.

Balsamaceae
The only foliage tested was an unknown species of touch-me-not, *Impatiens* sp. The foliage was unsuitable for larval development. Only first and second instars were tested and these larvae died.

Berberidaceae
The genera tested were *Berberis, Epimedium,* and *Nandina*. Host suitability was highly varied among the species in this family. Both new and old foliage from shining Oregon grape, *B. oregonensis*, and William Penn barberry, *B. gladwynnsis*, was very suitable for first instar development into adults. First through fifth instars died on bishop's hat, *E. rubrum*, although second through fifth instars did exhibit minor feeding. First through fifth instars died on new and old foliage of heavenly bamboo, *N. domestica*, although later instars did exhibit minor feeding.

Betulaceae
The genera tested were *Alnus, Betula,* and *Corylus*. Overall, the species were very suitable for gypsy moth larval development. First instars developed into adults on all seven species tested. However, the suitability of each alder species was very different. Larval development on foliage of red alder, *A. rubra*, and thinleaf alder, *A. tenuifolia*, resulted in four-fold and two-fold increase in pupal weights relative to white alder, *A rhombifolia*. The suitability of cut-leaf weeping birch, *B, pendula*, and European white birch, *B. verrucosa*, for larval development was comparatively high and similar to that of thin-leaf alder. Both native hazelnut, *C. cornuta*, and commercial hazelnut, *C. avellana*, were very suitable; larval development resulted in pupae of comparable weights to the tests involving the birch species.

Bignoniaceae
The species tested were northern catalpa, *Catalpa speciosa,* and empress tree, *Paulownia tomentosa*. The species were unsuitable for larval development. First through fifth instars died in all tests on both species. However, on northern catalpa fifth instars did exhibit minor feeding and on empress tree fourth and fifth instars exhibited minor feeding.

Boraginaceae
The genera tested were *Heliotropium, Lithodora, Myosotis,* and *Pulomonaria*. Overall, the species were unsuitable for larval development. First instars died on each of the four species tested. No further tests were conducted on common heliotrope, *H. arborescens*. On lithospermum, *L. diffusa*, second instars survived but resulted in very small pupae. No larvae survived on forget-me-not, *M. sylvatica*. Although third and fourth instars exhibited minor feeding on cowslip lungwort, *P. angustifolia*, all larvae died; fifth instars were not tested.

Brassicaceae
The species tested were cabbage, *Brassica oleracea*, and radish, *Raphanus*. The species were unsuitable for larval development. Only first and second instars were tested. No larvae survived, although minor feeding occurred on cabbage.

Buxaceae
The only species tested was common boxwood, *Buxus sempervirens*. The species was unsuitable for larval development. All first through fifth instars died on new and old foliage of common boxwood.

Cactaceae
The only species tested was *Pereskia grandifolia*. The species was unsuitable for larval development. First through fourth instars died on rose cactus; fifth instars were not tested.

Campanulaceae
The only species tested was bellflower, a species of *Campanula*. The species was unsuitable for larval development. Only first and second instars were tested; no larvae survived.

Cannabinaceae
The only species tested was hops, *Humulus lupulus*. The species was unsuitable for larval development. First and second instars died, although second instars exhibited minor feeding. Third instars developed into adults.

Caprifoliaceae
The genera tested were *Abelia*, *Lonicera*, *Symphoricarpos*, *Viburnum*, and *Weigela*. Overall, the species were poor hosts for larval gypsy moth development. First instars died on each of the six species tested. On glossy abelia, *A. grandiflora*, the remaining instars also died, although fifth instars did exhibit minor feeding. The remaining instars also died on twinberry, *L. involucrata*, and snowberry, *S. albus*. Two species of *Viburnum*, oval-leaf viburnum and leatherleaf viburnum were suitable for second instars to develop into adults, pupal weights were comparatively low. All larvae through the fifth instar died on common weigela, *W. florida*.

Caryophyllaceae
The species tested were carnation, *Dianthus caryophilus*, and agrostemma, *Lychnis coronaria*. The species were unsuitable for larval development. First through fifth instars died on carnation and agrostemma.

Casuarinaceae
The only species tested was coast beefwood, *Casuarina stricta*. The species was unsuitable for larval development. First and second instars died on coast beefwood, although second instars did exhibit minor feeding. Third instars developed into adults.

Celastraceae
The only species tested was evergreen euonymus, *Euonymus japonica*. The species was unsuitable for larval development. Although first and second instars exhibited minor feeding on evergreen euonymus no larvae survived on new foliage. Third instars developed into adults on new foliage. Old foliage was not tested.

Chenopodiaceae
The species tested were quail bush, *Atriplex lentiformis*, and swiss chard, *Beta vulgaris*. The species were unsuitable for larval development. First through fifth instars died in all tests on quail bush and swiss chard.

Cistaceae
The only species tested was rock rose, *Cistus carbariensis*. The species was very suitable for gypsy moth larval development. First instars developed into adults on rock rose.

Compositae
The genera tested were *Achillea, Artemesia, Aster, Baccharis, Centauria, Chrysanthemum, Echinops, Gaillardia, Matricaria, Osteospermum, Rudbeckia, Senecio, Tagetes,* and *Taraxacum*. Overall, the species were poor hosts for larval gypsy moth development. Among the 14 genera, involving 16 species, test results on suitability were highly variable. Fernleaf yarrow, *Ach. filipendula*, was unsuitable for all larvae from the first through fifth instar. However, yarrow, *Ach. tomentosa*, was suitable for first instar development into adults. The remaining species except for marigold, *T. erecta,* were unsuitable for first through fifth instars. Some minor feeding was noted for various instars on the different species but no larvae survived.

Convolvulaceae
The only species tested was morning glory, *Convolvulus arvensis*. The species was unsuitable for larval development. First through fifth instars died on a diet of morning glory.

Cornaceae
The genera tested were *Aucuba* and *Cornus*. Overall, the species were poor hosts for larval gypsy moth development. On foliage of Japanese aucuba, *A. japonica,* first through fifth instars died, although fifth instars exhibited minor feeding. First instars fed on flowering dogwood, *C. florida,* but then died. Second instars developed into fourth instars and then died. On red-osier dogwood, *C. stolonifera,* first instars died while second instars developed through the fifth-sixth instar into prepupae and then died. Larval development on the dogwoods was prolonged and the larvae were very small at the time of death, indicating that foliage is unsuitable even though larvae did molt to the next instar.

Crassulaceae
The only species tested was donkeytail, *Sedum morganianum*. The species was unsuitable for larval development. First through fifth instars died on a diet of donkeytail.

Cruciferae
The species tested were snowcap arabis, *Arabis* sp., and candytuft, *Iberis* sp. The species were unsuitable for larval development. First through fifth instar larvae died on a diet of snowcap arabis or candytuft.

Cucurbitaceae
The only species tested was bigroot, *Marah oreganus*. The species was unsuitable for larval development. First through fifth instars died.

Dipsacaceae
The only species tested was common teasel, *Dipsacus sylvetris*. The species was unsuitable for larval development. First through fith instars died, although fifth instars exhibited minor feeding.

Ebenaceae
The only species tested was persimmon, *Diospyros virginiana.* The species was a poor host for larval gypsy moth development. First instars fed slightly but died while second instars developed into adults.

Euphorbiaceae
The species tested were croton, *Codiaeum aucubaefolium,* and crown of thorns, *Euphorbia milii*. The species were unsuitable for larval development. First through fifth instars died on croton. First and second instars died on crown of thorns; no further tests were conducted.

Fagaceae
The genera tested were *Castanea, Fagus, Lithocarpus,* and *Quercus*. Overall, the species were very suitable for gypsy moth larval development. Of the thirteen species tested in this family all but interior live oak, *Q. wislizenii,* provided foliage suitable for first instar development to adults. Second instars on new foliage of interior live oak developed into adults. A diet of European beech, *F. sylvatica,* produced the lightest pupae among the plants suitable for first instar development. A diet of foliage from canyon live oak, *Q. chrysolepis,* or Oregon white oak, *Q. garryana,* produced the heaviest pupae. The suitability for development of various instars on old foliage (for the evergreen oaks) differed among species. Pupal weights for larvae fed old foliage were lighter than when larvae were fed new foliage.

Fumariaceae
The only species tested was common bleeding heart, *Dicentra spectabilis*. The species was unsuitable for larval development. First through fifth instars died.

Garryaceae
The only species tested was silk-tassel, *Garrya fremontii*. The species was unsuitable for larval development. First through fifth instars died on old foliage, although fourth and fifth instars exhibited minor feeding. New foliage was not tested.

Geraniaceae
The species tested were Lady Washington pelargonium, *Pelargonium domesticum,* and common geranium, *P. hortorum*. Overall, the species were unsuitable for larval development. First through fifth instars died on Lady Washington pelargonium, although fifth instars did exhibit minor feeding. On common geranium first and second instars died but third instars developed into adults.

Grossulariaceae
The species tested were black currant and alpine currant of the genus *Ribes*. First instars produced relatively small pupae but developed into adults on black currant. On alpine currant, *R. alpinum,* first through third instars died; fourth and fifth instars were not tested.

Hammamelidaceae
The only species tested was sweet gum, *Liquidambar styraciflua*. The species was moderately suitable for larval development. Larval development from the first instar produced relatively small pupae and adults.

Hippocastanaceae
The species tested were California buckeye, *Aesculus californica,* and horse chestnut, *A. hippocastanum*. The species were unsuitable for larval development. First through fifth instars died on foliage of California buckeye and horse chestnut.

Hydrangeaceae
The genera tested were bigleaf hydrangea, *Hydrangea macrophylla,* and mock orange, *Philadelphus* sp. The species were unsuitable for larval development. First and second instars died on a diet of foliage from bigleaf hydrangea. No additional tests were conducted. First and second instars died in the tests with mock orange, although second instars did exhibit minor feeding.

Hydrophyllaceae

The only species tested was waterleaf, *Hydrophyllum occidentale*. The species was unsuitable for larval development. First and second instars died on foliage of waterleaf; no additional tests were conducted.

Hypericaceae

The only species tested was god flower, *Hypericum moserianum*. The species was unsuitable for larval development. First through fifth instars died on a diet of new leaves of god flower. Old leaves were not tested.

Juglandaceae

The only species tested was black walnut, *Juglans nigra*. The species was a poor host for larval gypsy moth development. Although first instars exhibited minor feeding they died on foliage of black walnut. However, second instars developed into adults.

Labiatae

The genera tested were *Ajuga, Coleus, Melissa, Mentha, Origanum, Salvia,* and *Thymus*. Overall, the species were unsuitable for larval development. Thirteen species were tested with various instars capable of molting to successive instars but, with the exception of fifth instars on Clary sage, *S. sclarea,* larvae did not develop into adults on foliage the species in this family. First through fifth instars died on *Ajuga*, *Coleus*, and peppermint, *M. piperita*. On lemon balm, *M. officinalis;* marjoram, *O. majorana;* and common thyme, *T. vulgaris;* certain instars did molt but eventually died. Larvae died prior to molting on five of the seven sage species studied. First instars on purple sage, *S. leucophylla,* survived to the fourth instar but then died.

Lauraceae

The genera tested were *Cinnamonum, Persea,* and *Umbellularia*. Overall, the species were poor hosts for larval gypsy moth development. First instars developed into adults on new foliage of camphor tree, *C. camphora*. Pupae were small. First through fifth instars died on new foliage of zutano avocado, *P. americana,* although larvae did exhibit minor feeding. On old foliage of avocado first instars died but second instars developed into adults. Pupal weights were small-moderate. Old foliage of California laurel, *U. californica,* was not suitable for first through fifth instars, although minor feeding occurred; new foliage was not tested.

Leguminosae

The genera tested were *Acacia, Albizzia, Ceratonia, Cercis, Cytisus, Gleditsia, Laburnum, Medicago, Robinia, Spartium, Vicia, Wisteria*. Overall, the species were poor hosts for larval gypsy moth development. Results among the twelve genera and fifteen species tested were highly variable. First through fifth instars died on one of the three acacia species, *Acacia;* silk tree, *A. julibrissen;* new foliage of carob, *Ceratonia siliqua;* two species of redbud, *Cercis;* golden chain tree, *L. watereri;* and Spanish broom, *S. junceum*. Third instars were not tested on alfalfa, *M. sativa,* or Japanese wisteria, *W. floribunda,* but first and second instars died. First instars developed into adults on *Acacia baileyana* and new foliage of *A. longifolia*. Second instars developed into adults on old foliage of Sidney golden wattle, *A. longifolia*; Scotch broom, *C. scoparius;* and black locust, *R. pseudoacacia*. Third instars developed into adults on honey locust, *G. triacanthos,* and vetch, *Vicia*. Fourth instars developed into adults on old foliage of carob.

Limnanthaceae

The only species tested was meadowfoam, *Limnanthes* x *alba*. The species was unsuitable for larval development. First and second instars died, no additional tests were conducted.

Lobeliaceae
The only species tested was lobelia, *Lobelia erinus*. The species was unsuitable for larval development. First and second instars died on lobelia, no additional tests were conducted.

Loganiaceae
The species tested were butterfly bush, *Buddleja alternifolia*, and Carolina jessamine, *Gelsemium sempervirens*. The species were unsuitable for larval development. First through fifth instars died on foliage of either butterfly bush or Carolina jessamine.

Magnoliaceae
The species tested were tulip tree, *Liriodendron tulipifera*, and rustica rubra magnolia, *Magnolia soulangiana*. The species were unsuitable for larval development. First through fifth instars died on foliage of either tulip tree or rustica rubra magnolia. Fourth and fifth instars did exhibit minor feeding on tulip tree while fifth instars fed slightly on rubra rustica magnolia.

Malpighiaceae
The only species tested was crepe myrtle, *Lagerstroemia indica*. The species was a poor host for larval gypsy moth development. First instars died but second instars developed into adults. Pupae were small.

Malvaceae
The genera tested were *Hibiscus*, *Lavatera*, and *Malva*. Overall, the species were poor hosts for larval gypsy moth development. First instars developed into adults on tree mallow, *L. assurgentiflora*, pupae were small. On mallow, *M. neglecta*, first instars developed to the fifth instar but then died, larvae were small and slow to develop. First instars died but second instars developed into adults on Chinese hibiscus, *H. rosa-sinensis*. Pupae were small.

Melastomataceae
The only species tested was princess flower, *Tibouchina urvilleana*. The species was unsuitable for larval development. First and second instars died. No other tests were conducted.

Moraceae
The genera tested were *Ficus* and *Morus*. The species were unsuitable for larval development. First through fifth instars died on new and old foliage of weeping Chinese banyon, *F. benjamina*. Also, all larvae died on foliage of old mission fig, *M. carica*, and fruitless mulberry, *M. alba*, although fifth instars did exhibit minor feeding.

Myoporaceae
The only species tested were *Myoporum laetum* and *M. parvifolium* 'Putah Creek'. The species were unsuitable for larval development. First through fifth instars died in all tests although third through fifth instars exhibited minor feeding on *M. laetum*.

Myrsinaceae
The only species tested was *Ardisia japonica*. The species was unsuitable for larval development. First through fifth instars died on old foliage although fifth instars exhibited minor feeding. Old foliage was not tested.

Myrtaceae
The genera tested were *Callistemon*, *Eucalyptus*, and *Melaleuca*. Results for judging host suitability were highly variable among the species of this family. Fourteen species were tested, twelve of which were *Eucalyptus*. First through third instars died on new foliage of lemon bottlebrush, *C. citrinus*. No other tests were conducted. First through fifth instars died on old foliage of lemon bottlebrush; fifth instars exhibited minor feeding. First instars developed into adults on lilac melaleuca, *M. decussata;* pupal weights were moderate. Among the eucalyptus

species the results were variable. First instars developed into adults on four of the species: red gum, *E. camaldulensis;* silver dollar eucalyptus, *E. cinerea;* cider gum, *E. gunni;* and white peppermint, *E. pulchella*. On these species pupal weights ranged from moderate to high. First instars developed to fourth instars on *E. botrioides* and fifth instars on red ironbark, *E. sideroxylon,* but then died. First through fifth instars died on old foliage of red ironbark with only the fifth instars exhibiting minor feeding. First instars died but second instars developed into adults on white ironbark, *E. leucoxylon*. On four of the species larvae exhibited minor feeding but failed to molt in every case with the exception of fifth instars on silver dollar gum. On dwarf blue gum, *E. globulus,* first through fifth instars died without any attempt to feed on the foliage.

Nyctaginaceae
The only species tested was *Bougainvillea* x *buttiana* 'Barbara Karst'. The species was unsuitable for larval development. First through fifth instars died without exhibiting any feeding.

Oleaceae
The genera tested were *Forsythia, Fraxinus, Jasminum, Ligustrum, Olea,* and *Syringa*. The species were unsuitable for larval development. Eight species were tested and first through fifth instars died in all trials. Only on the three species of privet, *Ligustrum,* did second through fifth instars exhibit minor feeding.

Onagracaea
The species tested were hybrid fuchsia, *Fuchsia hybrida* and *Oenothera missourensis*. The species were unsuitable for larval development. First through fifth instars died, although third through fifth instars exhibited minor feeding on *O. missourensis*.

Oxalidaceae
The only species tested was *Oxalis regnelli*. The species was unsuitable for larval development. First through fifth instars died, although fourth and fifth instars exhibited minor feeding.

Paeoniaceae
The only species tested was peony, *Paeonia albiflora*. The species was unsuitable for larval development. First through fifth instars died without exhibiting any feeding.

Papaveraceae
The species tested were California poppy, *Eschscholzia californica,* and Oriental poppy, *Papaver orientale*. Overall, the species were unsuitable for larval development. First through fifth instars died on foliage of California poppy, although third through fifth instars exhibited minor feeding. First instars died on Oriental poppy but second instars developed into adults. However, pupae were very small.

Piperaceae
The only species tested was astrid peperomia, *Peperomia obtusifolia*. The species was unsuitable for larval development. First through fifth instars died without exhibiting any feeding.

Pittosporaceae
The only species tested was tobira, *Pittosporum tobira*. The species was unsuitable for larval development. First through fifth instars died on old foliage without any evidence of feeding. New foliage was not tested.

Plantaginaceae
The only species tested was plantain, *Plantago lanceolata*. The species was unsuitable for larval development. First instars died but second instars survived into the pupal stage where they then died.

Platanaceae
The only species tested was California sycamore, *Platanus racemosa*. The species was unsuitable for larval development. First through fifth instars died without any evidence of feeding.

Plumbaginaceae
The only species tested was sea pink, *Armeria maritima*. The species was unsuitable for larval development. First instars developed into adults.

Polemoniaceae
The only species tested was creeping phlox, *Phlox subulata*. The species was unsuitable for larval development. First through fifth instars died without any evidence of feeding.

Polygonaceae
The genera tested were *Eriogonum*, *Polygonum*, and *Rumex*. Six species of *Eriogonum* were tested. Overall, the species were poor hosts for larval gypsy moth development. First instars died on foliage of each species. Second instars developed into adults on two of the species: *E. giganteum* and *E. umbellatum*. Pupae were very small. The remaining larvae through the fifth instar all died although minor feeding occurred on one of the species, *E. wrightii*. First through fifth instars died on an unknown species of *Polygonum*, although minor feeding occurred in the tests using third through fifth instars. First instars developed into adults on *Rumex crispus*. Pupae were small.

Polypodiaceae
The only species tested was sword fern, *Polystichum munitum*. The species was unsuitable for larval development. First through fifth instars died on new foliage of sword fern. Old foliage was not tested.

Portulacaceae
The only species tested was rose moss, *Portulaca grandiflora*. The species was unsuitable for larval development. First and second instars died on rose moss. No other instars were tested.

Primulaceae
The species tested were florists' cyclamen, *Cyclamen persicum* and polyanthus primula, *Primula polyantha*. The species were unsuitable for larval development. First through fifth instars died on florists' cyclamen and polyanthus primula. Fifth instars did exhibit minor feeding on the cyclamen.

Proteaceae
The only species tested were grevillea, *Grivellia 'noellii'*, and silk oak, *G. robusta*. The species were unsuitable for larval development. First through fifth instars died on each species although minor feeding occurred by fifth instars on grevillea and third through fifth instars on silk oak.

Punicaceae
The only species tested was pomegranate, *Punica granatum*. The species was a poor host for larval gypsy moth development. First instars died although minor feeding occurred. Second instars developed into adults; pupae were small.

Ranunculaceae
The genera tested were *Aquilegia*, *Clematis*, *Delphinium*, and *Helleborus*. The species were unsuitable for larval development. One species in each genus was tested. First through fifth instars died in all tests. Only fourth and fifth instars on western clematis, *C. liguticifolia*, exhibited minor feeding.

Rhamnaceae

The genera tested were *Ceanothus* and *Rhamnus*. Five species of *Ceanothus* were tested. Overall, the species were unsuitable for larval development. Only on *C. maritimus* were larvae able to develop into adults and on this species it was from the first instar. Two species of *Rhamnus* were tested. The species were unsuitable for larval development. First through fifth instars died although feeding occurred in third-fifth instars.

Rosaceae

The genera tested were *Amelanchier, Cotoneaster, Crataegus, Eriobotrya, Geum, Heteromeles, Holodiscus, Lyonothamnus, Oemleria, Photinia, Prunus, Pyracantha, Pyrus, Raphiolepsis, Rosa, Rubus, Sorbus,* and *Spiraea*. Thirty-five species were tested and the results were extremely varied, even among congeneric plants. Many species were well suited for gypsy moth larval development. Similarly, many species were poorly suited or unsuitable for larval development. First instars developed into adults on 17 species in 10 genera: *Amelanchier, Crateagus, Lyonothamnus, Photinia, Prunus, Pyracantha, Pyrus, Raphiolepsis, Rosa,* and *Sorbus*. The pupal weights ranged from low to high depending on the species comprising the diet. First instars died but second instars developed into adults on seven species in five genera: *Cotoneaster, Heteromeles, Prunus, Raphiolepsis,* and *Rubus*. First and second instars died but third instars developed into adults on one species: *Eriobotrya japonica*. First through fifth instars died on five species in four genera: *Geum, Oemleria, Prunus,* and *Rubus*. The genera showing marked differences among species in their palatibility to gypsy moth larvae were *Prunus, Raphiolepsis,* and *Rubus*.

Rubiaceae

The species tested were coffee, *Coffea arabica*; cleavers *Galium aparine*; and gardenia, *Gardenia jasminoides*. The species were unsuitable for larval development. First through fifth instars died on foliage of each species, although minor feeding did occur by fifth instars on leaves of cleavers and gardenia.

Rutaceae

The genera tested were *Choisya*, *Citrus*, and *Skimmia*. Overall, the species were poor hosts for larval gypsy moth development. A total of five species were tested. First through fifth instars died on foliage of Mexican orange, *Choisya ternata*, and skimmia, *Skimmia japonica*. However, the three species of *Citrus* were fed upon to varying degrees depending on foliage type and variety. Old and new foliage of Meyer lemon, *C. limoni*, was suitable for second instar development into adults (first instars died); pupal weights were light. First instars died on new and old foliage of marsh grapefruit, *C. paradisi*. Also, second through fifth instars died on old foliage but second instars developed into adults on new foliage. Three varities of *C. sinensis* were tested: navel orange, Valencia orange, and tangerine. First instars died on new and old foliage of each variety although minor feeding did occur on new foliage of navel orange. Second instars developed into adults on new foliage of tangerine and Valencia orange. Pupal weights were moderate to moderately high. No larvae (first through fifth instars) survived on old foliage of tangerine or Valencia orange. However, fourth instars developed into adults on old foliage of navel orange.

Salicaceae

The genera tested were *Populus* and *Salix*. A total of nine species were tested. Overall, the species were very suitable for gypsy moth larval development. First instars developed into adults on each of the four species of *Populus*: Fremont cottonwood, *P. fremontii*; Lombardy poplar, *P. nigra 'italica'*; quaking aspen, *P. tremuloides*; and black cottonwood, *P. trichocarpa*. Pupal weights were low on Fremont cottonwood and quaking aspen, moderate on black cottonwood, and relatively high on Lombardy poplar. First instars developed into adults on each of the five species of *Salix*: golden weeping willow, *S. alba tristis*; corkscrew willow, *S. babylonica*; pussy willow, *S. discolor*; scouler willow, *S. scouleriana*; and *S. lasepolis*. Pupal weights were very high on the first two species mentioned above while pupae were moderately heavy on the latter three species.

Saxifragaceae
The genera tested were *Astilbe*, *Escallonia*, and *Tolmiea*. Overall, the species were poor hosts for larval gypsy moth development. Of the three species tested, only false spirea, *A. japonica*, was totally unsuitable for larval development into adults. All first through fifth instars died. However, on foliage of piggy-back plant, *T. menziessi*, first instars exhibited minor feeding and died while second instars developed into adults. Average pupal weights were moderately high. On foliage of pink escallonia, *E. laevis*, first and second instars died although second instars exhibited some feeding, while third instars developed into adults.

Scrophulariaceae
The genera tested were *Digitalis, Hebe, Mimulus, Nemesia*, and *Veronica*. The species were unsuitable for larval development. All larvae from first through fifth instars died on each of the five species tested: foxglove, *D. purpurea*; hebe, *H. anomala;* Plumas monkey flower, *M. bifidus*; dwarf mix, *N. strumosa*; and royal blue speedwell, *V. teucrium*.

Solanaceae
The genera tested were *Lycopersicon*, *Petunia* and *Solanum*. The species were unsuitable for larval development. All larave from the first through fifth instars died on each of the five species tested: tomato, *L. esculentum*, common garden petunia, *P. hybrida*, and three species of *Solanum*: bittersweet, *S. dulcamara*; potato vine, *S. jasminoides*; and blue potato vine, *S. rantonnetii*.

Sterculiaceae
The only species tested was California glory, *Fremontodendron californicum*. The species was very suitable for gypsy moth larval development. First instars developed into adults on new foliage. Pupal weights were moderate.

Styracaceae
The only species tested was silver bell, *Halesia carolina*. The species was unsuitable for larval development. First through fifth instars died although fifth instars did exhibit minor feeding.

Theaceae
The species tested were camellia, *Camellia japonica*, and mountain stewartia, *Stewartia ovata*. The two species differed dramatically in host suitability. All larvae from first through fifth instars died on new and old foliage of camellia. Larvae developed into adults from the first instar on foliage of mountain stewartia. Pupal weights were low.

Thymeliaceae
The only species tested was winter daphne, *Daphne odora*. First through fifth instars died in these tests.

Tiliaceae
The species tested were American linden, *Tilia americana*, and little-leaf linden, *T. cordata*. The species were moderately suitable for larval development. First instars developed into adults on foliage of either species. Pupal weights were low.

Ulmaceae
The species tested were American elm, *Ulmus americana*; chinese elm, *U. parvifolia;* and sawleaf zelkova, *Zelkova serrata*. Overall, the species were very suitable for gypsy moth larval development. First instars developed into adults on foliage of either elm. Pupal weights were moderate. First instars feed on foliage of sawleaf zelkova but died. Second instars developed into prepupae but then died.

Urticaceae
The only species tested was stinging nettle, *Urtica dioica*. The species was unsuitable for larval development. Although first and second instars exhibited minor feeding they died prior to molting. Third instars developed into adults.

Verbenaceae
The only species tested was lantana, *Lantana montevidensis*. The species was unsuitable for larval development. First through fifth instars died in these tests.

Violaceae
The only species tested was tricolor pansy, *Viola wittrockiana*. The species was unsuitable for larval development. First through fifth instars died in these tests.

Vitaceae
The genera tested were *Cissus* and *Vitis*. The species were unsuitable for larval development. First through fifth instars died on foliage of grape ivy, *C. rhombifolia*. Three varieties of grape, *V. vinifera*; were tested: Cabernet Sauvignon, Concord, and Thompson's seedless. First through fifth instars died on foliage of each grape variety.

<u>Overview on host plant suitability.</u>

Results of gypsy moth feeding trials were compiled for 658 species in 286 genera, representing 106 families and 46 orders of dicots (Appendix II). Our studies contributed a substantial portion of the data presented in this appendix. By our definition of an acceptable host, plant species in 63 genera (22.0 per cent) were accepted. Whereas, plant species in 210 genera (73.4 per cent) were rejected. Feeding tests on plants in 13 genera (4.6 per cent) showed notable differences among congeneric species. Plant genera yielding the highest female pupal weights (greater than 1200 mg) and shortest developmental time (30 days at $23 \pm 2^{o}C$) are the same genera known to be suitable hosts under field conditions (see Lechowicz 1983, Lechowicz and Jobin 1983, Lechowicz and Mauffette 1986). Therefore, we feel confident that the results of the host plant tests used in the database for this study are generally consistent with field observations.

TAXONOMIC PATTERNS. An analysis of the higher taxonomic affinities of accepted and rejected plants revealed distinct taxonomic patterns. The majority of accepted plants belong to Cronquist's (1981) subclasses Hamamelidae, Dilleniidae, and Rosidae. Most genera of Magnoliidae, Caryophyllidae, and Asteridae were rejected. These patterns probably reflect underlying phylogenetic constraints on the taxonomic distribution of allelochemics (Gershenzon and Mabry 1983, Gottlieb 1982).

Hamamelidae. Species in 17 of the 25 tested genera (68.0 per cent) were accepted by the gypsy moth. Rejected species were mostly in the Urticales, in particular, the Moraceae and Platanaceae. Larvae fed foliage from species of Fagales (Betulaceae and Fagaceae), especially oaks (*Quercus*), consistently yielded female pupal weights above 1200 mg. The Hamamelidae are rich in tannins but generally depauperate in other allelochemics (Giannasi 1986).

Dilleniidae. Species in 11 of the 39 tested genera (28.2 per cent) were accepted by the gypsy moth. Suitable hosts were largely confined to species within the Ericaceae, Salicaceae, and Malvales (Malvaceae, Sterculiaceae, and Tiliaceae). Larvae fed foliage from species of *Arbutus* (Ericaceae) and *Vaccinium* (Ericaceae) produced large pupae but a majority of the Ericaceae were rejected. Larvae fed foliage from some species of *Populus* (Salicaceae) yielded large pupae while other species were rejected.

Rosidae. Species in 29 of the 112 tested genera (25.9 per cent) were acceptable to the gypsy moth. Suitable hosts were largely confined to species within the Aceraceae, Anacardiaceae, and especially Rosaceae. Although the Rosaceae contains many genera that were accepted by gypsy moth larvae, larvae fed foliage from most test plants in this family produced female pupae less than 1000 mg (except on *Photinia*). Larvae fed foliage from species within the Anacardiaceae often yielded large pupae. In the Aceraceae, larvae fed foliage from some species of *Acer* yielded large pupae while other species were rejected.

Magnoliidae. Species in 4 of the 23 tested genera (17.4 per cent) were accepted by the gypsy moth. The only accepted hosts were species in Berberidaceae and Lauraceae. *Berberis* and *Mahonia* appeared to be quite suitable hosts for the gypsy moth but species of Lauraceae appear to be only marginally suitable. We found that new, but not old, leaves of camphor tree could support development of some first instars, whereas old leaves were more suitable than new leaves of avocado.

Caryophyllidae. Species in only one of the 12 tested genera (8.3 per cent) were accepted by the gypsy moth. The only accepted genus was *Armeria* in the Plumbaginaceae. Two species of *Eriogonum*, *E. giganteum* and *E. umbellatum*, were accepted by second instars in our tests but most species of this genus were rejected by all instars.

Asteridae. Species in only one of the 75 tested genera (1.3 per cent) were accepted by the gypsy moth. The one acceptable genus was *Carissa* (Apocynaceae), tested by Edwards and Fusco (1979). Genera belonging to the Asteridae are generally rich in alkaloids and terpenoids and depauperate in tannins.

Other taxa. Brief notes should be made concerning some plants not shown in Appendix I. In general, foliage from monocots (e.g., Liliaceae, Palmae, Gramineae, Araceae) was rejected by the gypsy moth. The only records of acceptance are *Musa* and *Canna* (Kurir 1953). Among gymnosperms, many species of Pinaceae were acceptable hosts. For example, Miller and Hanson (in press) found that larvae fed foliage of European larch, *Larix decidua*; blue spruce, *Picea pungens*, new foliage; lodgepole pine, *Pinus contorta*; and Douglas-fir, *Pseudotsuga menziesii*, yielded female pupal weights over 1200 mg. However, some genera of Pinaceae have species (e.g., *Pinus sylvestris*) that were not accepted until later instars. Among the Taxodiaceae, *Metasequoia* and *Sequoia* (new foliage) were accepted in some trials but not in others; *Cunninghamia* and *Sequoiadendron* were never accepted by first instars. All species of Araucaraceae, Cupressaceae, Ephedraceae, Ginkgoaceae, Podocarpaceae, and Taxaceae that have been tested were unacceptable. Of the few fern species that have been tested, all were rejected.

ALLELOCHEMIC PATTERNS. Comparison of results of gypsy moth feeding tests with known distributions of allelochemics (Table 4) reveals certain patterns. In general, plants containing tannins exhibited the highest percentage of acceptance. The highest percentage of rejection occurred among plants containing alkaloids, terpenoids, or other non-tannin allelochemics. The following is a discussion concerning certain allelochemical constituents of plant foliage and host suitability for gypsy moth larval development.

Tannins and other phenolics. Species in 182 of the tested genera contain tannins. Species in 76 (41.8 per cent) of these genera were accepted by gypsy moth larvae. Species in all 63 genera which were classified as accepted contain tannins. Except for *Achillea* (Asteraceae), all 13 genera showing a variable response among congeneric species contain tannins. Also, the 10 genera that we noted as rejected by first instars but accepted by second instars contain tannins, except *Papaver* (Papaveraceae). Thus, the host range of gypsy moth appears to be strongly associated with plants containing tannins. We observed no differences in acceptance of foliage between plants containing condensed and hydrolyzable (trihydroxy constituents) tannins.

Condensed tannins are widely distributed in vascular plants, whereas hydrolyzable tannins are confined to dicots, particularly Hamameliidae, Rosidae, and Dilleniidae (i.e., the same subclasses containing the majority of accepted genera). Both types of tannins are rare in the Caryophyllidae and Asteridae (subclasses which contain mostly rejected genera). The taxonomic distribution of tannins reflect phylogenetic constraints; their presence in herbaceous Rosaceae and Leguminosae and their absence in many woody Asteridae demonstrate that there is a strong relationship based on phylogeny rather than with the woody habit (Bate-Smith and Metcalfe 1957). Thus, the occurrence of tannins in "apparent" plants (see Feeny 1976, Rhoades and Cates 1976) may be more a consequence of phylogeny than of herbivore selection pressure.

Like many other allelochemics, tannins are probably phagodeterrent to non-adapted species and phagostimulants to adapted, specialist herbivore species (Bernays 1981, Martin et al. 1985). In laboratory studies, tannic acid elicited phagostimulation in gypsy moth (Meisner and Skatulla 1975). Higher levels of tannins, such as those observed in oak leaves from trees defoliated the previous season, may negatively affect gypsy moth performance (Schultz and Baldwin 1982). However, increased mortality of gypsy moth on foliage picked later in the season may be caused by a decrease in water and nitrogen and an increase in toughness, not to changes in tannin levels (Hough and Pimentel 1978, Lawson et al. 1984).

Other phenolics do not appear to be associated with either acceptance or rejection by the gypsy moth. In field studies host acceptance by gypsy moth was more closely associated with tannin content than with total phenol content of leaves (Lechowicz 1983). Flavanoids isolated from *Kalmia* (Ericaceae) were not deterrent to gypsy moth (El Naggar et al. 1980). Data on phenolic distributions in Ericaceae (Harborne and Williams 1973) and in species of *Eucalyptus* (Hillis 1967) do not suggest an association with acceptance or rejection by the gypsy moth.

Alkaloids. Species in 162 of the 286 genera tested are known to contain alkaloids in leaf tissues. Species in 139 (85.8 per cent) of the alkaloid-containing genera were rejected. Many of the alkaloids that we record here were not characterized more specifically. However, where possible we noted alkaloid types.

Isoquinoline alkaloids show a taxonomic distribution consistent with hypothesized phylogeny of plant families (Gershenzon and Mabry 1983). These compounds occur predominantly in families belonging to Cronquist's (1981) Magnoliidae (e.g., Aristolochiaceae, Berberidaceae, Fumariaceae, Lauraceae, Magnoliaceae, Menispermaceae, Papaveraceae, and Ranunculaceae). We found records of isoquinolines in 21 of the tested genera, 18 of which were rejected. Species were accepted only in *Berberis* and *Mahonia*.

Isoquinoline alkaloids are the only alkaloids that have been incorporated into artifical diet in tests with gypsy moth. Miller and Feeny (1983) investigated the effects of six benzylisoquinoline alkaloids on three polyphagous Lepidoptera, including the gypsy moth. Aristolochic acid, berberine, and sanguinarine gave dramatic toxic or repellent effects on gypsy moth larvae. Also, papaverine decreased consumption rates but not growth efficiency. Gluacine had little affect on consumption rate.

We found records of 15 genera with indole alkaloids, 10 of which were rejected. Except for *Carissa* (Apocynaceae), acceptance of genera with indole alkaloids was confined to those with simple indoles. Simple indole alkaloids, such as gramine in *Acer* (Aceraceae), serotonin in *Hippophae* (Eleagnaceae), and *Prunus* (Rosaceae) are widely distributed (Smith 1977). Indole alkaloids, produced by more complex biosynthetic pathways involving the acetate pathway, are confined primarily to Apocynaceae, Loganiaceae, and Rubiaceae (Gottlieb 1982, Gershenzon and Mabry 1983).

Alkaloidal amines occur in a diversity of plant taxa but are notably present in the closely related Cactaceae, Chenopodiaceae, and Nyctaginaceae (Gibbs 1974). We found records of alkaloidal amines in 10 genera, eight of which were rejected by gypsy moth larvae. *Acacia* (Leguminosae) and *Prunus* (Rosaceae) each have some species that were accepted. Purines, pyridines, and pyrrolidines also occur in many plant families. We found records of purines in eight genera, all of which were rejected by gypsy moth larvae. Pyridines occur in 19 genera 16 of which were rejected and three exhibited variable acceptance. Pyrrolidines occur in six genera, five of which were rejected and one showed variable response. Pyrrolizidines are present in five genera (Boraginaceae, Asteraceae, and Leguminosae), quinazolines in two genera (Acanthaceae and Hydrangeaceae), quinolines in four genera (Asteraceae and Rutaceae), quinolizidines in nine genera (one in Asteraceae, the others in Leguminosae), and steroid alkaloids are present in four genera (Buxaceae and Solanaceae). All genera containing these alkaloids were rejected.

Some alkaloid types with a very restricted distribution are not listed in our compilation: alkaloidal peptides (Rhamnaceae: *Ceanothus*), diterpenoid alkaloids (Ranunculaceae: *Delphinium* and certain Garryaceae), indolizidines (Moraceae - *Ficus*), monoterpenoid alkaloids (Actinidiaceae), and tropanes (Convovulaceae). None of these taxa were accepted.

Our results agree with those of Barbosa and Krischik (1987) and further document the general unsuitability of alkaloid-containing plants to the gypsy moth. An exception involves those plants containing only simple indole alkaloids (e.g., *Acer*, *Hippophae*, *Prunus*). We found various species of *Acer* and *Prunus* to be fairly suitable for gypsy moth larval development. However, the levels of indole alkaloids in each species was not determined.

Terpenoids. Simple monoterpenoids are distributed among a wide variety of plants but the morphological capacity to accumulate them is restricted to certain plant taxa (Seigler 1981). Plant species capable of accumulating monoterpenoids include families accepted by the gypsy moth (e.g., Pinaceae, Anacardiaceae, Juglandaceae, Rosaceae) as well as families rejected by the gypsy moth (e.g., Cupressaceae, Apiaceae, Araliaceae, Asteraceae, Euphorbiaceae, Geraniaceae, Lamiaceae, Myrtaceae, Pittosporaceae, Rutaceae). It is possible that rejection is associated with higher concentrations of simple monoterpenes. Meisner and Skatulla (1975) found that camphene detered the gypsy moth at 0.05 per cent concentration, whereas higher concentrations (0.2 per cent) of a-pinene, B-pinene, and 3-carene were required to deter feeding. Limonene was not a feeding deterrent at 0.2 per cent concentration. The distribution of terpenoids in *Eucalyptus* indicates that rejected species (Appendix III) have higher concentrations of cineole (Hillis 1967).

Our results suggest that the presence of iridoids in foliage contributes to rejection by the gypsy moth. Iridoids were recorded from 35 of the genera tested, 31 (88.6 per cent) of which were rejected. In *Viburnum* (Caprifoliaceae) the response varied among species. The paucity of gypsy moth hosts among iridoid-containing genera and families might be explained by the absence of tannins and prevalence of iridoids and biosynthetically related alkaloids (complex indoles) in these taxa.

The taxonomic distribution of iridoid monoterpenes is closely correlated with plant phylogeny. In fact, some plant taxonomists have used data on iridoid presence-absence in realigning certain taxa (Dahlgren 1980). Iridoids are found in most families of Asteridae but are absent in Asteraceae, Boraginaceae, and Solanaceae. Outside Asteridae, iridoids are found primarily in Cornales and Ericaceae.

Iridoids are antifeedants for Lepidoptera that do not normally feed on these plants (Bernays and DeLuca 1981) and feeding stimulants for species specializing on these plants (Bowers 1983). Host specific Lepidoptera on iridoid-containing plants sequester or otherwise metabolize ingested iridoids, whereas the gypsy moth eliminates the intact compounds in the feces (Bowers and Puttick 1986).

Sesquiterpenoids constitute the largest group of terpenoids (Seigler 1981) but have a rather restricted taxonomic distribution, occurring primarily in Asteraceae, Lauraceae, Magnoliaceae, and Myrtaceae. Sesquiterpenoids were recorded from 22 of the plant genera tested, 17 (77.3 per cent) of which were rejected. In previous studies sesquiterpenoids isolated from *Melaleuca* (Myrtaceae) and *Liriodendron* (Magnoliaceae) were deterrents to gypsy moth feeding (Doskotch et al. 1980a, 1980b). In our study, congeneric species of *Melaleuca* and *Eucalyptus* varied in acceptability. Only rejected species of *Eucalyptus* contain sesquiterpenoids (chemical data from Penfold and Willis 1961). Thus, acceptability of *Eucalyptus* species (and perhaps *Melaleuca* species) may be determined by presence or absence of sesquiterpenoids as well as by concentrations of monoterpenoids.

Although diterpenoids occur in a variety of plant families, we have restricted our compilation to the most complete data set which involves the Ericaceae and Lamiaceae. Ten grayanoid diterpenes have been isolated from *Kalmia* (Ericaceae) that were antifeedants to gypsy moth (El Naggar et al. 1980). Our data suggest that these results might be extended to the Ericaceae as a whole. We might predict that those genera rejected by gypsy moth may contain diterpenoids, whereas acceptable genera lack them. Diterpenoids present in mints (Lamiaceae) have apparently not been tested on gypsy moth, but clerodane in *Ajuga* is deterrent to *Spodoptera littoralis*, another species that is very polyphagous (Belles et al. 1985).

Triterpenoid saponins (e.g., cucurbitacins) were not included in our compilation, but these compounds may account for gypsy moth rejection in many of the taxa in which they occur (e.g., Araliaceae).

Other allelochemics. Glucosinolates have a very restricted taxonomic distribution and are recorded from only five of the 286 genera tested. Among the test plants, all of the glucosinolate-containing genera are in the Brassicaceae and Limnanthaceae, all of which were rejected. Gypsy moth apparently has not been tested using isolated glucosinolates in artificial diet. These compounds are toxic to other Lepidoptera that do not normally feed on plants containing them (Blau et al. 1978). Alkaloids are recorded from some Brassicaceae and therefore it is uncertain whether alkaloids, glucosinolates, or both determine the response of the gypsy moth.

Raphide crystals are sparsely but widely distributed among various plant taxa. Gibbs (1974) records them in 10 of the tested genera belonging to the Actinidiaceae, Aizoaceae, Balsaminaceae, Hydrangeaceae, Nyctaginaceae, Onagraceae, Rubiaceae, and Vitaceae, all of which were rejected by gypsy moth. Raphides are deterrents to some Lepidoptera but attractants to those which feed on these plants (e.g., sphingids; Ehrlich and Raven 1964). Alkaloids are present in some of these plant taxa, but in other taxa (Aizoaceae, Onagraceae, and Vitaceae) no alkaloids (or terpenoids) have been recorded.

CONCLUSIONS

Our results and the literature suggest that the gypsy moth accepts plants that contain tannins but lack other major allelochemics, such as alkaloids, iridoids, and sesquiterpenes. This pattern can be used to predict the suitability of plant taxa which have not been tested in feeding trials with gypsy moth. However, predictions on plant suitability do contain an element for error and may be placed into at least four categories accordingly: (1) based on familial relationships, (2) based on generic relationships, (3) based on chemical composition of a given species, or (4) based on the conduct of a laboratory bioassay using either live foliage or artificial diet with allelochemics incorporated. Fairly accurate predictions can often be made even with category 1 data because the taxonomic distribution of gypsy moth hosts reflects well (better at the generic level than the familial level) the taxonomic distribution of certain allelochemics. Category 4 predictions on host suitability should be the most accurate but the required field research may not always be feasible.

In several of the plant taxa rejected by gypsy moth, presence of more than one type of allelochemic makes it difficult to determine which allelochemic is the major deterrent. For example, many Asteraceae contain monoterpenoids, sesquiterpenoids, and alkaloids. Further research is needed to determine if one of these allelochemicals is more of a deterrent than the others. It is quite likely that no single type of allelochemic will explain all cases of rejection by gypsy moth. Additionally, seasonal occurrence of allelochemicals and other leaf qualities (e.g., toughness, pubescence) could influence host suitability.

The gypsy moth is often cited as an example of a polyphagous herbivore. Much of this reputation is based on the feeding behavior of fourth and fifth instars. Our results, emphasizing the feeding behavior of first instars, suggest that this species is certainly polyphagous, but not indiscriminantly so. Some of the apparent polyphagy derives from a temperate zone bias in the choice of plants tested against the gypsy moth. It became clear during our laboratory tests that as more plants with tropical origins were included, the proportion of rejections increased. This pattern is not surprising since the gypsy moth is indigenous to north temperate zones.

It may be that monophagous and polyphagous species choose host plants on a similar basis, only the identity of the allelochemic stimulant varies. Thus, herbivores that are stimulated to feed by an allelochemical with a wide taxonomic distribution (like tannins) will appear to be polyphagous.

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TABLE 1. Acceptance of plant species according to instar of gypsy moth.

INSTAR	NO. PLANT SPECIES ACCEPTED (n)	CUMULATIVE NO. PLANT SPECIES ACCEPTED
I	101 (326)	101
II	34 (325)	135
III	9 (308)	144
IV	1 (303)	145
V	2 (297)	147

TABLE 2. Weight of female pupae from rearing first instars on respective plants (*n* = new foliage, *o* = old foliage).

Pupal weight (mg)		
1200-1900+	900-1199	400-899
Acer macrophyllum	*Alnus tenuifolia*	*Acacia baileyana*
Alnus rubra	*Arbutus menziesii*^{n}	*Acer circinatum*
Arbutus menziesii^{o}	*Berberis gladwynensis*^{n}	*Acer negundo*
Eucalyptus cinerea^{n}	*Betula verucosa*	*Alnus rhombifolia*
Lithocarpus densiflorus^{n}	*Castanea sativa*	*Amelanchier alnifolia*
Populus nigra	*Corylus cornuta*	*Berberis aquifolium*^{o}
Quercus agrifolia^{n}	*Photinia glabra*	*Crataegus monogyna*
Quercus engelmannii	*Raphiolepis ballevira*^{n}	*Fagus sylvatica*
Quercus garryana	*Rosa indica*^{n}	*Gaultheria shallon*^{o}
Quercus lobata	*Rosa sp.*	*Hibiscus rosasinensis*
Rhus typhina	*Salix discolor*	*Liquidambar styraciflua*
	Schinus molle	*Myrica californica*^{o}
	Ulmus americana	*Prunus laurocerasus*^{o}
	Ulmus parvifolia	*Prunus salicina*
	Vaccinium corymbosum	*Prunus virginiana*
		Pyracantha coccinea
		Quercus kelloggii
		Ribes sp.
		Rosa rubiginosa
		Rubus parviflorus
		Rumex crispus
		Sorbus aucuparia
		Stewartia ovata
		Tilia americana
		Tilia cordata

TABLE 3. Plant genera with species eliciting different feeding responses from gypsy moth larvae (numbers refer to sources of data: (1) Miller and Hanson this study; (2) Edwards and Fusco 1979; (3) Kurir 1953; (4) Mosher 1915.

Plant genus	Accepted species	Rejected species
Acer	*campestre* (3)	*dasycarpum* (3)
	carpinifolium (3)	*pennsylvanicum* (4)
	circinatum (1,2)	*spicatum* (4)
	heldreichii (3)	
	macrophyllum (1,2)	
	monspessulanum (3)	
	negundo (1,2,3)	
	platanoides (2,4)	
	platanus (3)	
	pseudoplatanus (3)	
	rubrum (1,4)	
	saccharinum (3,4)	
	saccharum (4)	
	tataricum (3)	
Eucalyptus	*camaldulensis* (2)	*botryoides* (2)
	cinerea (2)	*camphora* (2)
	ficifolia (1)	*diversifolia* (2)
	gunii (1,2)	*globulus* (1,2)
	linearis (1,2)	*leucoxylon* (2)
	melliodora (1)	*ligustrina* (1)
		maculosa (1)
		nicholii (1)
		polyanthemos (2)
		rudis (2)
		sideroxylon (2)
Euonymus	*verrucosa* (3)	*fortunei* (1)
		japonica (2)
Populus	*alba* (3)	*candicans* (3)
	balsamifera (4)	*tremula* (3)
	canadensis (3)	
	fremontii (2)	
	grandidentata (4)	
	nigra (2,3,4)	
	tremuloides (1,2,4)	
	trichocarpa (2)	
Prunus	most spp.	*lyonii* (1)
		persica (1,2)

Table 3 continued.

Plant genus	Accepted species	Rejected species
Rhamnus	*cathartica* (3) *purshiana* (1,2,3)	*californica* (1,2) *frangula* (3) *saxatilis* (3)
Ribes	*aureum* (3) *nigrum* (3) *rubrum* (3) *viburnifolium* (1)	*alpinum* (2) *grossularia* (3) *leptanthum* (3) *vulgare* (4) *sanguineum* (1)
Rubus	*parviflorus* (2)	*discolor* (2) *fruticosus* (3) *idaeus* (3)
Spiraea	*menziesii* (3) *prunifolia* (3) *splendens* (3) *thunbergii* (3)	*cantoniensis* (3) *salicifolia* (4) *tomentosa* (4) *sp.* (2)
Viburnum	*davidi* (1) *lantana* (3) *opulus* (3,4')	*acerifolium* (4) *cassinoides* (4) *dentatum* (4) *ellipticum* (2) *japonicum* (1) *lentago* (4) *suspensum* (1) *tinus* (1) *rhytidophyllum* (2,3)

Table 4. Gypsy moth response to plants containing various allelochemics. Data compiled from Appendix II.

Allelochemic	No. plant genera	No. accepted (% accepted)	No.rejected (%rejected)
OVERALL	286	76 (22.0)	210 (73.4)
TANNINS	182	74 (40.7)	108 (59.3)
ALKALOIDS	162	23 (14.2)	139 (85.8)
amine	10	2 (20)	8 (80)
indole	15	5 (33.3)	10 (66.7)
isoquinoline	21	3 (14.3)	18 (85.7)
purine	8	0 (0)	8 (100)
pyridine	19	3 (15.8)	16 (84.2)
pyrrolidine	6	1 (16.7)	5 (83.3)
pyrrolizidine	5	0 (0)	5 (100)
quinazoline	2	0 (0)	2 (100)
quinoline	4	0 (0)	4 (100)
quinolizidine	9	0 (0)	9 (100)
steroid	4	0 (0)	4 (100)
IRIDOIDS	35	4 (11.4)	31 (88.6)
SESQUITERPENOIDS	22	5 (22.7)	17 (77.3)
GLUCOSINOLATES	5	0 (0)	5 (100)
RAPHIDES	10	0 (0)	10 (100)

APPENDIX I. The response and development of gypsy moth larvae to foliage of prospective host plants.

Tests used:
I = first instar
II = second instar
III = third instar
IV = fourth instar
V = fifth instar

Larval response:
0 = no (or very little) feeding, no frass, no molt.
+ = some feeding, some frass, no molt.
* = well fed, plenty of frass, molt.
. = no data available.

The first line following plant species names is for new foliage, the second line (following family name) is for old foliage.

For successful development from instar I or II:
P=live female pupal weight in milligrams, 3 days after pupation.

Genus species Family (Common name)	I	II	III	IV	V	P
Abelia grandiflora	0	0	0	0	+	.
Caprifoliaceae						
(glossy abelia)						
Acacia baileyana	*	*	*	*	*	653
Leguminosae						
(Bailey acacia)						
Acacia longifolia	*	*	*	*	*	662
Leguminosae	0	*	*	*	*	867
(Sydney golden wattle)						
Acacia redolens	+	+	+	+	+	.
Leguminosae						
Acer circinatum	*	*	*	*	*	475
Aceraceae						
(vine maple)						
Acer macrophyllum	*	*	*	*	*	1210
Aceraceae						
(big-leaf maple)						
Acer negundo	*	*	*	*	*	809
Aceraceae						
(boxelder)						
Acer platanoides	*	*	*	*	*	921
Aceraceae						
(Norway maple)						
Achillea filipendula	+	+	+	+	+	.
Compositae						
(fernleaf yarrow)						
Achillea tomentosa	*	*	*	*	*	764
Compositae						
(yarrow)						
Actinidia chinensis	0	0	0	0	+	.
Actinidiaceae						
(kiwi)						

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Aesculus californica Hippocastanaceae (California buckeye)	0	0	0	0	0	.
Aesculus hippocastanum Hippocastanaceae (horse chestnut)	0	0	0	0	0	.
Ajuga reptans Labiateae (ajuga)	0	0	0	0	0	.
Albizzia julibrissin Leguminosae (silk tree)	0	0	0	0	0	.
Alnus rhombifolia Betulaceae (white alder)	*	*	*	*	*	431
Alnus rubra Betulaceae (red alder)	*	*	*	*	*	1744
Alnus tenuifolia Betulaceae (thinleaf alder)	*	*	*	*	*	981
Amelanchier alnifolia Rosaceae (serviceberry)	*	*	*	*	*	303
Aquilegia sp. Ranunculaceae (columbine)	0	0	0	0	0	.
Arabis sp. Cruciferae (snowcap arabis)	0	0	0	0	+	.
Aralia spinosa Araliaceae (devil's walking stick)	0	0	0	0	0	.
Arbutus menziesii Ericaceae (madrone)	*	*	*	*	*	928
	*	*	*	*	*	1338
Arbutus unedo Ericaceae (strawberry tree)	*	*	*	*	*	634
Arctostaphylos columbiana Ericaceae (hairy manzanita)	+	*	*	*	*	632
Arctostaphylos densiflora Ericaceae (vine hill manzanita)	*	*	*	*	*	1151
Arctostaphylos hookeri Ericaceae (Monterey carpert)	*	*	*	*	*	889
Arctostaphylos manzanita Ericaceae (common manzanita)	*	*	*	*	*	713
Arctostaphylos uva-ursi Ericaceae (kinikinnic)	*	*	*	*	*	1456

APPENDIX I continued.

Genus species Family (Common name)	Instar					
	I	II	III	IV	V	P
Ardisia japonica Myrsinaceae (ardisia)	0	0	0	0	+	.
Aristolochia californica Aristolochiaceae (California dutchman's pipe)	0	0	0	0	0	.
Armeria maritima Plumbaginaceae (sea pink)	*	*	*	*	*	710
Artemisia pycnocephala Compositae (sandhill sage)	0	0	0	0	0	.
Asparagus setaceus Liliaceae (plumosa fern)	0	0	0	0	0	.
Aster alpinus Compositae	0	0	0	+	+	.
Astilbe japonica Saxifragaceae (false spiraea)	0	0	0	0	0	.
Atriplex lentiformis Chenopodiaceae (quail bush)	0	0	0	0	0	.
Aucuba japonica Cornaceae (Japanese aucuba)	0	0	0	0	+	.
Baccharis pilularis Compositae (coyote bush)	0	0	0	0	0	.
Begonia sp. Begoniaceae (rex begonia)	+	+	.	.	.	.
Begonia sp. Begoniaceae (wax begonia)	0	0	+	+	+	.
Berberis aquifolium Berberidaceae (shining Oregon grape)	* *	* *	* *	* *	* *	1347 811
Berberis gladwynnsis Berberidaceae (William Penn barberry)	* *	* *	* *	* *	* *	1005 943
Beta vulgaris Chenopodiaceae (Swiss chard)	0	0	0	0	0	.
Betula pendula Betulaceae (cut-leafed weeping birch)	*	*	*	*	*	1012
Betula verrucosa Betulaceae (European white birch)	*	*	*	*	*	1100
Bougainvillea x buttiana Nyctaginaceae (Barbara Karst)	0	0	0	0	0	.

APPENDIX I continued.

Genus species Family (Common name)	Instar					
	I	II	III	IV	V	P
Brassica oleracea Brassicaceae (cabbage)	+	+	.	.	.	.
Buddleja alternifolia Loganiaceae (butterfly bush)	0	0	0	0	0	.
Buxus sempervirens Buxaceae (common boxwood)	0 0	0 0	0 0	0 0	0 0	. .
Callistemon citrinus Myrtaceae (lemon bottlebrush)	0 0	0 0	0 0	. 0	. +	. .
Camellia japonica Theaceae (camellia)	0 0	0 0	0 0	0 0	* 0	. .
Campanula sp. Campanulaceae (bellflower)	0	0	.	.	.	.
Castanea sativa Fagaceae (Spanish chestnut)	*	*	*	*	*	1023
Casuarina stricta Casuarinaceae (coast beefwood)	0	+	*	*	*	.
Catalpa speciosa Bignoniaceae (northern catalpa)	0	0	0	0	+	.
Ceanothus griseus Rhamnaceae (Carmel creeper)	0	0	+	+	+	.
Ceanothus integerimus Rhamnaceae (deer brush)	0	+	+	+	+	.
Ceanothus maritimus Rhamnaceae	*	*	*	*	*	866
Ceanothus 'Ray Hartman' Rhamnaceae (wild lilac)	0	0	0	0	0	.
Ceanothus sp. Rhamnaceae (wild lilac)	0	0	0	0	0	.
Centauria cyanus Compositae (Montana blue)	0	+	+	+	+	.
Ceratonia siliqua Leguminosae (carob)	+ 0	+ 0	+ +	+ *	+ *	. .
Cercis canadensis Leguminosae (eastern redbud)	0	0	0	0	0	.
Cercis occidentalis Leguminosae (western redbud)	0	0	0	0	+	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Chamaerops humilis Arecaceae (Mediterranean fan palm)	0	0	0	0	+	.
Choisya ternata Rutaceae (Mexican orange)	0	0	0	0	0	.
Chrysanthemum frutescens Compositae (yellow marguerite)	0	0	0	0	0	.
Chrysanthemum morifolium Compositae (florists' chrysanthemum)	0	0	0	0	+	.
Cinnamonum camphora Lauraceae (camphor tree)	*	*	*	*	*	529
Cissus rhombifolia Vitaceae (grape ivy)	0	0	0	0	+	.
Cistus carbariensis Cistaceae (rock rose)	*	*	*	*	*	818
Citrus limoni Rutaceae (Meyer lemon)	+ +	* *	* *	* *	* *	614 600
Citrus paradisi Rutaceae (marsh grapefruit)	0 0	* 0	* 0	* +	* +	907 .
Citrus sinensis Rutaceae (navel orange)	+ 0	* 0	* 0	* *	* *	935 .
Citrus sinensis Rutaceae (tangerine)	0 0	* 0	* 0	* 0	* +	269 .
Citrus sinensis Rutaceae (valencia orange)	0 0	* 0	* 0	* +	* +	1114 .
Clematis ligusticifolia Ranunculaceae (western clematis)	0	0	0	+	+	.
Codiaeum aucubaefolium Euphorbiaceae (croton)	0	0	0	0	0	.
Coffea arabica Rubiaceae (coffee)	0	0	0	0	0	.
Coleus hybridus Labiatae (coleus)	0	0	0	0	0	.
Convolvulus arvensis Convolvulaceae (field morning glory)	0	0	0	0	0	.
Cornus florida Cornaceae (flowering dogwood)	+	*	*	died	.	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Cornus stolonifera Cornaceae (red-osier dogwood)	0	*	*	*	*	died
Corylus avellana Betulaceae (European filbert)	*	*	*	*	*	903
Corylus cornuta Betulaceae (western hazelnut)	*	*	*	*	*	831
Cotinus coggygria Anacardiaceae (smoke tree)	*	*	*	*	*	1013
Cotoneaster horizontalis Rosaceae (rock cotoneaster)	+	*	*	*	*	285
Crataegus monogyna Rosaceae (one-seed hawthorn)	*	*	*	*	*	557
Crossandra infundibuliformis Acanthaceae (crossandra)	0	0	.	.	.	.
Cyclamen persicum Primulaceae (florists' cyclamen)	0	0	0	0	+	.
Cytisus scoparius Leguminosae (Scotch broom)	+	*	*	*	*	545
Daphne odora Thymeliaceae (winter daphne)	0	0	0	0	0	.
Delphinium elatum Ranunculaceae (larkspur)	0	0	0	0	0	.
Dianthus caryophilus Caryophyllaceae (carnation)	0	0	0	0	0	.
Dicentra spectabilis Fumariaceae (common bleeding heart)	0	0	0	0	0	.
Digitalis purpurea Scrophulariaceae (common foxglove)	0	0	0	0	0	.
Diospyros virginiana Ebenaceae (persimmon)	+	*	*	*	*	853
Dipsacus sylvestris Dipsacaceae (common teasel)	0	0	0	0	+	.
Dizygotheca elegantissima Araliaceae (threadleaf false aralia)	0	0	0	0	0	.
Echinops exaltatus Compositae (globe thistle)	+	+	+	+	+	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Epimedium rubrum Berberidaceae (bishop's hat)	0	+	+	+	+	.
Eriobotrya japonica Rosaceae (loquat)	0	+	*	*	*	.
Eriogonum giganteum Polygonaceae (St. Catherine's Lace)	+	*	*	*	*	441
Eriogonum grande Polygonaceae (red buckwheat)	0	0	0	0	0	.
Eriogonum hybridum Polygonaceae	0	0	0	0	0	.
Eriogonum latifolium Polygonaceae	0	0	0	0	0	.
Eriogonum umbellatum Polygonaceae (sulfur flower)	+	*	*	*	*	467
Eriogonum wrightii Polygonaceae	0	0	+	+	+	.
Escallonia laevis Saxifragaceae (pink escallonia)	0	+	*	*	*	.
Eschscholzia californica Papaveraceae (California poppy)	0	0	+	+	+	.
Eucalyptus botrioides Myrtaceae	*	*	*	died		.
Eucalyptus camaldulensis Myrtaceae (red gum)	*	*	*	*	*	879
Eucalyptus camphora Myrtaceae	+	+	+	+	+	.
Eucalyptus cinerea Myrtaceae (silver dollar eucalyptus)	*	*	*	*	*	1719
Eucalyptus diversifolia Myrtaceae	+	+	+	+	+	.
Eucalyptus globulus Myrtaceae (dwarf blue gum)	0	0	0	0	0	.
Eucalyptus gunnii Myrtaceae (cider gum)	*	*	*	*	*	1463
Eucalyptus leucoxylon Myrtaceae (white ironbark)	+	*	*	*	*	546
Eucalyptus polyanthemos Myrtaceae (silver dollar gum)	+	+	+	+	*	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Eucalyptus pulchella Myrtaceae (white peppermint)	*	*	*	*	*	804
Eucalyptus rudis Myrtaceae (desert gum)	+	+	+	+	+	.
Eucalyptus sideroxylon Myrtaceae (red ironbark)	* 0	* 0	* 0	* 0	died +	. .
Euonymus japonica Celastraceae (evergreen euonymus)	+	+	*	*	*	.
Euphorbia milii Euphorbiaceae (crown of thorns)	0	0	.	.	.	.
Fagus sylvatica Fagaceae (European beech)	*	*	*	*	*	715
Fatsia japonica Araliaceae (Japanese aralia)	0	0	0	0	0	.
Ficus benjamina Moraceae (weeping Chinese banyan)	0 0	0 0	0 0	0 0	0 0	. .
Ficus carica Moraceae (old mission fig)	0	0	0	0	+	.
Forsythia intermedia Oleaceae (forsythia)	0	0	0	0	0	.
Fraxinus latifolia Oleaceae (Oregon ash)	0	0	0	0	0	.
Fremontodendron californicum Sterculiaceae (California glory)	*	*	*	*	*	1127
Fuchsia hybrida Onagraceae (hybrid fuchsia)	0	0	0	0	0	.
Gaillardia aristata Compositae (Burgundy gaillardia)	0	0	0	0	0	.
Galium aparine Rubiaceae (cleavers)	0	0	0	0	+	.
Gardenia jasminoides Rubiaceae (gardenia)	0	0	0	0	+	.
Garrya fremontii Garryaceae (silk-tassel)	0	0	0	+	+	.
Gaultheria shallon Ericaceae (salal)	* *	* *	* *	* *	* *	1373 661

APPENDIX I continued.

Genus species Family (Common name)	Instar					
	I	II	III	IV	V	P
Gelsemium sempervirens Loganiaceae (Carolina jessamine)	0	0	0	0	0	.
Geum quellyon Rosaceae (Mrs. Bradshaw)	+	+	+	+	+	.
Gleditsia triacanthos Leguminosae (honey locust)	0	0	*	*	*	.
Grevillea 'noellii' Proteaceae (grevillea)	0	0	0	0	+	.
Grevillea robusta Proteaceae (silk oak)	0	0	+	+	+	.
Halesia carolina Styracaceae (silver bell)	0	0	0	0	+	.
Hebe anomala Scrophulariaceae (hebe)	0	0	0	0	0	.
Hedera helix Araliaceae (English ivy)	0 0	0 0	0 0	0 0	0 0	. .
Heliotropium arborescens Boraginaceae (common heliotrope)	0	.	.	.	.	.
Helleborus orientalis Ranunculaceae (lenten rose)	0	0	0	0	0	.
Heteromeles arbutifolia Rosaceae (toyon)	+	*	*	*	*	237
Hibiscus rosa-sinensis Malvaceae (Chinese hibiscus)	0	*	*	*	*	511
Holodiscus discolor Rosaceae (ocean spray)	0	+	.	.	.	.
Humulus lupulus Cannabinaceae (hops)	0	+	*	*	*	.
Hydrangea macrophylla Hydrangeaceae (bigleaf hydrangea)	0	0	.	.	.	.
Hydrophyllum occidentale Hydrophyllaceae (waterleaf)	0	+	.	.	.	.
Hypericum moserianum Hypericaceae (gold flower)	0	0	0	0	0	.
Iberis sp. Cruciferae (candytuft)	0	0	0	0	0	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Ilex aquifolium Aquifoliaceae (English holly)	0	0	0	0	0	.
Impatiens sp. Balsamaceae (touch-me-not)	0	0	.	.	.	.
Jasminum nudiflorum Oleaceae (winter jasmine)	0	0	0	0	0	.
Juglans nigra Juglandaceae (black walnut)	+	*	*	*	*	685
Laburnum watereri Leguminosae (golden chain tree)	0	0	0	0	+	.
Lagerstroemia indica Malpighiaceae (crepe myrtle)	0	*	*	*	*	328
Lampranthus spectabilis Aizoaceae (trailing ice plant)	0	0	0	0	0	.
Lantana montevidensis Verbenaceae (lantana)	0	0	0	0	0	.
Lavatera assurgentiflora Malvaceae (tree mallow)	*	*	*	*	*	752
Ligustrum japonicum Oleaceae (Japanese privet)	0	+	+	+	+	.
Ligustrum lucidum Oleaceae (glossy privet)	0	+	+	+	+	.
Ligustrum 'Vicaryi' Oleaceae (Vicary golden privet)	0	+	+	+	+	.
Limnanthes x alba Limnanthaceae (meadow foam)	0	0	.	.	.	.
Liquidambar styraciflua Hammamelidaceae (sweet gum)	*	*	*	*	*	819
Liriodendron tulipifera Magnoliaceae (tulip tree)	0	0	0	+	+	.
Lithocarpus densiflorus Fagaceae (tan oak)	* 0	* 0	* *	* *	* *	1203 .
Lithodora diffusa Boraginaceae (lithospermum)	0	*	*	*	*	521
Lobelia erinus Lobeliaceae (lobelia)	0	0	.	.	.	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Lonicera involucrata Caprifoliaceae (twinberry)	0	0	0	0	0	.
Lupinus Russell Hybrids Leguminosae (Russell lupine)	0	0	0	0	0	.
Lychnis coronaria Caryophyllaceae (agrostemma, blood red)	0	0	0	0	0	.
Lycopersicon esculentum Solanaceae (tomato)	0	0	0	0	0	.
Lyonothamnus floribundus Rosaceae (Catalina ironwood)	* .	* .	* .	* .	* .	1120 .
Magnolia soulangiana Magnoliaceae (rustica rubra)	0	0	0	0	+	.
Malva neglecta Malvaceae (mallow)	*	*	*	*	died	.
Marah oreganus Cucurbitaceae (bigroot)	0	0	0	0	0	.
Matricaria matricarioides Compositae (pineapple weed)	0	0	0	0	0	.
Medicago sativa Leguminosae (alfalfa)	0	0	.	.	.	.
Melaleuca decussata Myrtaceae (lilac melaleuca)	*	*	*	*	*	1072
Melissa officinalis Labiatae (lemon balm)	0	*	*	*	*	died
Mentha piperita Labiatae (peppermint)	0	0	.	.	.	.
Mimulus bifidus Scrophulariaceae (Plumas monkey flower)	0	0	0	0	0	.
Morus alba Moraceae (fruitless mulberry)	0	0	0	0	+	.
Myoporum laetum Myoporaceae	0	0	+	+	+	.
Myoporum parvifolium Myoporaceae (Putah creek)	0	0	0	0	0	.
Myosotis sylvatica Boraginaceae (forget-me-not)	0	0	0	0	0	.

APPENDIX I continued.

Genus species Family (Common name)	Instar					
	I	II	III	IV	V	P
Myrica californica						
Myricaceae	*	*	*	*	*	458
(Pacific waxmyrtle)						
Nandina domestica	0	0	0	0	+	.
Berberidaceae	0	0	0	+	+	.
(heavenly bamboo)						
Nemesia strumosa	0	0	0	0	0	.
Scrophulariaceae						
(dwarf mix)						
Nerium oleander	0	0	0	0	+	.
Apocynaceae	0	0	0	0	0	.
(oleander)						
Oemleria cerasiformis	0	0	0	0	+	.
Rosaceae						
(Indian plum)						
Oenothera missourensis	0	0	+	+	+	.
Onagraceae						
Olea europaea	0	0	0	0	0	.
Oleaceae	0	0	0	0	0	.
(olive)						
Origanum majorana	*	*	*	*	*	427
Labiatae						
(marjoram)						
Osmarea burkwoodii	+	.	.	.	.	.
Oleaceae	0	0	.	.	.	.
(osmarea)						
Osteospermum fruiticosum	0	0	0	0	+	.
Compositae						
(African daisy)						
Oxalis regnellii	0	0	0	+	+	.
Oxalidaceae						
(oxalis)						
Paeonia albiflora	0	0	0	0	0	.
Paeoniaceae						
(peony)						
Papaver orientale	0	*	*	*	*	410
Papaveraceae						
(oriental poppy)						
Paulownia tomentosa	0	0	0	+	+	.
Bignoniaceae						
(empress tree)						
Pelargonium domesticum	0	0	0	0	+	.
Geraniaceae						
(Lady Washington pelargonium)						
Pelargonium hortorum	0	0	*	*	*	.
Geraniaceae						
(common geranium)						
Peperomia obtusifolia	0	0	0	0	0	.
Piperaceae						
(astrid peperomia)						
Pereskia grandifolia	0	0	0	0	.	.
Cactaceae						
(rose cactus)						

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Persea americana Lauraceae (zutano avocado)	+ 0	+ *	+ *	+ *	+ *	. 750
Petunia hybrida Solanaceae (common garden petunia)	0	0	0	0	0	.
Philadelphus sp. Hydrangeaceae (mock orange)	0	+	.	.	.	.
Phlox subulata Polemoniaceae (creeping phlox)	0	0	0	0	0	.
Photinia glabra Rosaceae (Japanese photinia)	*	*	*	*	*	1086
Pieris japonica Ericaceae (lily-of-the-valley)	0 0	0 0	0 0	0 0	0 0	. .
Pistacia vera Anacardiaceae (pistachio)	*	*	*	*	*	1075
Pittosporum tobira Pittosporaceae (tobira)	0	0	0	0	0	.
Plantago lanceolata Plantaginaceae (plantain)	0	*	*	*	*	died
Platanus racemosa Platanaceae (California sycamore)	0	0	0	0	0	.
Polygonum sp. Polygonaceae (knotweed)	0	0	+	+	+	.
Populus fremontii Salicaceae (Fremont cottonwood)	*	*	*	*	*	465
Populus nigra 'italica' Salicaceae (Lombardy poplar)	*	*	*	*	*	1413
Populus tremuloides Salicaceae (quaking aspen)	*	*	*	*	*	589
Populus trichocarpa Salicaceae (black cottonwood)	*	*	*	*	*	658
Portulaca grandiflora Portulacaceae (rose moss)	0	0	.	.	.	.
Primula polyantha Primulaceae (polyanthus primula)	0	0	0	0	0	.
Prunus glandulosa Rosaceae (dwarf flowering almond)	+	*	*	*	*	322

APPENDIX I continued.

Genus species Family (Common name)	Instar					
	I	II	III	IV	V	P
Prunus illicifolia x lyoni Rosaceae (hollyleaf cherry)	+ 0	+ 0	+ .	+ .	+ .	. .
Prunus laurocerasus Rosaceae (English laurel)	*	*	*	*	*	671
Prunus lyoni Rosaceae	+	+	+	+	+	.
Prunus persica Rosaceae (heavenly white nectarine)	0	+	+	.	.	.
Prunus persica Rosaceae (tilton apricot)	*	*	*	*	*	1459
Prunus persica Rosaceae (peach)	0	+	.	.	.	.
Prunus salicina Rosacea (Santa Rosa plum)	*	*	*	*	*	809
Prunus virginiana Rosaceae (common chokecherry)	*	*	*	*	*	750
Pulomonaria angustifolia Boraginaceae (cowslip lungwort)	0	0	+	+	.	.
Punica granatum Punicaceae (pomegranate, 'wonderful')	+	*	*	*	*	418
Pyracantha coccinea Rosaceae (fire thorn)	*	*	*	*	*	558
Pyrus communis Rosaceae (pear)	*	*	*	*	*	672
Pyrus malus Rosaceae (apple)	*	*	*	*	*	912
Quercus agrifolia Fagaceae (coast live oak)	* +	* *	* *	* *	* *	1455 823
Quercus chrysolepis Fagaceae (canyon live oak)	* +	* +	* *	* *	* *	2045 .
Quercus douglasii Fagaceae (blue oak)	*	*	*	*	*	557
Quercus engelmannii Fagaceae (Engelmann oak)	* *	* *	* *	* *	* *	1464 752
Quercus garryana Fagaceae (Oregon white oak)	*	*	*	*	*	1951

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Quercus kelloggii Fagaceae (California red oak)	*	*	*	*	*	958
Quercus lobata Fagaceae (valley oak)	*	*	*	*	*	1579
Quercus rubra Fagaceae (red oak)	*	*	*	*	*	837
Quercus suber Fagaceae	*	*	*	*	*	1443
Quercus wislizenii Fagaceae (interior live oak)	0	*	*	*	*	905
Raphanus sp. Brassicaceae (radish)	0	0	.	.	.	.
Raphiolepsis ballevira Rosaceae (Indian hawthorn)	* +	* *	* *	* *	* *	1009 1020
Raphiolepsis indica Rosaceae (India hawthorn)	0	*	*	*	*	787
Rhamnus californica Rhamnaceae (coffeeberry)	0	0	+	+	+	.
Rhamnus purshiana Rhamnaceae (cascara)	*	*	*	*	*	463
Rhododendron sp. Ericaceae (azalea)	*	*	*	*	*	530
Rhododendron sp. Ericaceae (PJM rhododendron)	+ *	* *	* *	* *	* *	234 250
Rhus diversiloba Anacardiaceae (poison oak)	*	*	*	*	*	1254
Rhus typhina Anacardiaceae (staghorn sumac)	*	*	*	*	*	1428
Ribes sp. Grossulariaceae (black currant)	*	*	*	*	*	813
Ribes alpinum Grossulariaceae (alpine currant)	+	+	+	.	.	.
Robinia pseudoacacia Leguminosae (black locust)	+	*	*	*	*	1178
Rosa sp. Rosaceae (bajazzo)	*	*	*	*	*	1106

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Rosa sp. Rosaceae (climbing rose)	*	*	*	*	*	501
Rosa sp. Rosaceae (mon cheri)	*	*	*	*	*	734
Rosa sp. Rosaceae (show biz)	*	*	*	*	*	612
Rosa eglanteria Rosaceae (sweetbrier)	*	*	*	*	*	666
Rubus sp. Rosaceae (red raspberry)	0	*	*	*	*	724
Rubus discolor Rosaceae (Himalayan blackberry)	0	+	+	+	+	.
Rubus parviflorus Rosaceae (thimbleberry)	+	*	*	*	*	597
Rubus spectabilis Rosaceae (salmonberry)	+	*	*	*	*	352
Rudbeckia hirta Compositae (rustic colors)	0	0	+	+	+	.
Rumex crispus Polygonaceae (curly dock)	*	*	*	*	*	492
Saintpaulia ionantha Gesneriaceae (African violet)	0	0	0	0	0	.
Salix alba tristis Salicaceae (golden weeping willow)	*	*	*	*	*	1586
Salix babylonica Salicaceae (corkscrew willow)	*	*	*	*	*	1083
Salix discolor Salicaceae (pussy willow)	*	*	*	*	*	1018
Salix lasepolis Salicaceae	*	*	*	*	*	1003
Salix scouleriana Salicaceae (scouler willow)	*	*	*	*	*	975
Salvia clevelandii Labiateae	0	+	+	+	+	.
Salvia greggi Labiateae	0	0	0	0	0	.

APPENDIX I continued.

Genus species Family (Common name)	Instar					
	I	II	III	IV	V	P
Salvia leucophylla Labiateae (purple sage)	*	*	*	died		.
Salvia officinalis Labiatae (sage)	+	+	.	.	.	.
Salvia sclarea Labiateae (Clary sage)	0	+	+	+	*	.
Salvia sonorensis Labiateae	0	0	0	0	0	.
Salvia uliginosa Labiateae	0	0	0	+	+	.
Schefflera arboricola Araliaceae (Hawaiian elf schefflera)	0	0	0	0	0	.
Schinus molle Anacardiaceae (California peppertree)	*	*	*	*	*	1065
Sedum morganianum Crassulaceae (donkeytail)	0	0	0	0	0	.
Senecio jacobae Compositae (tansy ragwort)	0	0	0	0	0	.
Skimmia japonica Rutaceae (skimmia)	0	0	0	0	0	.
Solanum dulcamara Solanaceae (bittersweet)	0	0	0	0	0	.
Solanum jasminoides Solanaceae (potato vine)	0	0	0	0	0	.
Solanum rantonnetii Solanaceae (blue potato vine)	0	0	0	0	0	.
Sorbus aucuparia Rosaceae (European mountain.ash)	*	*	*	*	*	542
Spartium junceum Leguminosae (Spanish broom)	0	0	0	0	0	.
Spiraea sp. Rosaceae	+	+	.	.	.	.
Stewartia ovata Theaceae (mountain stewartia)	*	*	*	*	*	622
Symphoricarpos albus Caprifoliaceae (common snowberry)	0	0	0	+	+	.

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Syringa vulgaris Oleaceae (common lilac)	0	0	0	0	0	.
Tagetes erecta Compositae (American marigold)	+	*	*	*	died	.
Taraxacum officinale Compositae (common dandelion)	0	0	0	0	0	.
Thymus vulgaris Labiatae (common thyme)	*	*	*	*	died	.
Tibouchina urvilleana Melastomataceae (princess flower)	0	0	.	.	.	.
Tilia americana Tiliaceae (American linden)	*	*	*	*	*	691
Tilia cordata Tiliaceae (little-leaf linden)	*	*	*	*	*	687
Tolmiea menziesii Saxifragaceae (piggy-back plant)	+	*	*	*	*	1210
Trachycarpus fortunei Arecaceae (windmill palm)	0	0	0	0	+	.
Ulmus americana Ulmaceae (American elm)	*	*	*	*	*	950
Ulmus parvifolia Ulmaceae (chinese elm)	*	*	*	*	*	1158
Umbellularia californica Lauraceae (California laurel)	+	+	+	+	+	.
Urtica dioica Urticaceae (stinging nettle)	+	+	*	*	*	.
Vaccinium corymbosum Ericaceae (blueberry)	*	*	*	*	*	889
Vaccinium parvifolium Ericaceae (red blueberry)	*	*	*	*	*	749
Vaccinium vitis-idaea minus Ericaceae (lingon berry)	*	*	*	*	*	350
Veronica teucrium Scrophulariaceae (royal blue speedwell)	0	0	0	0	0	.
Viburnum ellipticum Caprifoliaceae (oval-leafed viburnum)	0	*	*	*	*	708

APPENDIX I continued.

Genus species Family (Common name)	Instar I	II	III	IV	V	P
Viburnum rhytidophyllum Caprifoliaceae (leatherleaf viburnum)	+	*	*	*	*	451
Vicia sp. Leguminosae (vetch)	+	+	*	*	*	.
Vinca minor Apocynaceae (dwarf periwinkle)	0	0	0	0	0	.
Viola wittrockiana Violaceae (tricolor pansy)	0	0	0	0	0	.
Vitis vinifera Vitaceae (cabernet savignon)	0	0	0	0	0	.
Vitis vinifera Vitaceae (concord grape)	0	0	0	0	+	.
Vitis vinifera Vitaceae (Thompson's seedless)	0	0	0	0	0	.
Weigela florida Caprifoliaceae (common weigela)	0	0	0	0	0	.
Wisteria floribunda Leguminosae (Japanese wisteria)	+	+	.	.	.	.
Zelkova serrata Ulmaceae (sawleaf zelkova)	+	*	*	*	*	died

APPENDIX II. Results of gypsy moth feeding studies and allelochemic records of the test plants. PLANT SUBCLASSES: I=Magnoliidae, II=Hamamelidae, III=Caryophyllidae, IV=Dilleniidae, V=Rosidae, VI=Asteridae. ALLELOCHEMICS: A=alkaloid, a=alkaloid amine, i=indole, is=isoquinoline, p=purine, pi=pyridine, pd=pyrrolidine, pz=pyrrolizidine, q=quinazoline, qn=quinoline, qz=quinolizidine, st=steroid. Terpenoids: D=diterpenoid, I=iridoid monoterpene, S=sesquiterpene. Tannins: C=condensed tannins, H=hydrolyzable tannins. Other compounds: G=glucosinolate, R=raphide. ()=presence of specified allelochemical inferred. GYPSY MOTH RESPONSE: +=development from instar I, (0)=development from instar II, 0=no development by instars I or II, *=response was different among congeneric plant species. REFERENCES: 1=Miller and Hanson, this study; 2=Edwards and Fusco 1979; 3=Kurir 1953; 4=Mosher 1915; #'=discrepant results for plant genus among authors.

Family (Order) Genus, # spp. tested	Allello-chemics	Gypsy moth response	Reference
ACANTHACEAE (VI-Scrophulariales)			
Acanthus 1	A	0	2
Crossandra 1		0	1
Justicia 1	A:q	0	2
ACERACEAE (V-Sapindales)			
Acer 17	A:i;C,H	*	1,2,3,4
ACTINIDIACEAE (IV-Theales)			
Actinidia 1	A;C,H;R	0	1
AIZOACEAE (III-Caryophyllales)			
Lampranthus 1	C;R	0	1
ANACARDIACEAE (V-Sapindales)			
Cotinus 1	C,H	+	1,2
Pistacia 2	C,(H)	+	1,2
Rhus 8	A;C,(H)	+	1,2,3,4
Schinus 1	C,H	+	1
APIACEAE (V-Apiales)			
Petroselinum 1	A	0	2
APOCYNACEAE (VI-Gentianales)			
Carissa 1	A:i;C	+	2
Nerium 1	A;(C)	0	1,2
Vinca 2	A:i;(C);I	0	1,2
AQUIFOLIACEAE (V-Celastrales)			
Ilex 7	A:p,pi	0	1,2,3,4
ARALIACEAE (V-Apiales)			
Aralia 3	A:p	0	1,2,4
Fatsia 1		0	1,3
Hedera 1		0	1,2
Schefflera 1		0	1
ARISTOLOCHIACEAE (I-Aristolochiales)			
Aristolochia 1	A:is	0	1

APPENDIX II continued.

ASTERACEAE (VI-Asterales)			
Achillea 2	A:pi,pd;S	*	1
Artemisia 2	A;D;S	0	1,2
Aster 1	A;S	0	1
Baccharis 1	A	0	1
Centaurea 1	A;S	0	1
Chrysanthemum 3	A:pd;S	0	1,2
Echinops 1	A:qn	0	1
Gaillardia 1	A;S	0	1
Helianthus 1	A	0	2
Matricaria 1	A;S	0	1
Osteospermum 1		0	1
Rudbeckia 1	A	0	1
Santolina 1		0	2
Senecio 1	A:pz,qz;S	0	1
Tagetes 1	H	0	1
Taraxacum 1	S	0	1
Tussilago 1	A:pz	0	3
BALSAMINACEAE (V-Geraniales)			
Impatiens 1	A;C;R	0	1
BEGONIACEAE (IV-Violales)			
Begonia 2	C	0	1,3
BERBERIDACEAE (I-Ranunculales)			
Berberis 3	A:is;C	+	1,2,3
Epimedium 1	A:is;H	0	1
Mahonia 2	A:is;C	+	1,2,3
Nandina 1	A:is;(C)	0	1
BETULACEAE (II-Fagales)			
Alnus 6	A;C,H	+	1,2,3,4
Betula 12	C,H	+	1,2,3,4
Carpinus 2	C,H	+	3,4
Corylus 5	C,H	+	1,2,3,4
Ostrya 2	C,(H)	+	3,4
BIGNONIACEAE (VI-Scrophulariales)			
Catalpa 1	A;I	0	1,4
Paulownia 1	I	0	1
BORAGINACEAE (VI-Lamiales)			
Heliotropum 1	A:pz	0	1
Lithodora 1		0	1
Myosotis 1		0	1
Pulmonaria 1		0	1
BRASSICACEAE (IV-Capparales)			
Arabis 1	A;G	0	1
Brassica 1	A:is;G	0	1,2
Iberis 1	G	0	1,2
Raphanus 1	G	0	1
BUDDLEJACEAE (VI-Scrophulariales)			
Buddleja 1	A;I	0	1
BUXACEAE (V-Euphorbiales)			
Buxus 2	A:is,st	0	1,2,3
Sarcococca 1	A:st	0	2
CACTACEAE (III-Caryophyllales)			
Pereskia 1		0	1
CALYCANTHACEAE (I-Laurales)			
Calycanthus 4	A:i	0	2,3
CAMPANULACEAE (VI-Campanulales)			
Campanula 1	A	0	1
Lobelia 1	A:pi	0	1

APPENDIX II continued.

CANNABACEAE (II-Urticales)			
Humulus 1	A:is;C,H;S	0	1
CAPRIFOLIACEAE (VI-Dipsacales)			
Abelia 1	C;I	0	1,2
Diervilla 1	(C)	0	4
Lonicera 6	A;(C);I	0	1,2,3
Sambucus 3	A:pi;(C);I	0	3,4
Symphoricarpos 2	A;(C);I	0	1,3
Viburnum 12	A;C;I	*	1,2,3,4
Weigela 2	(C);I	0	1,3
CARYOPHYLLACEAE (III-Caryophyllales)			
Dianthus 1	A	0	1
Lychnis 1		0	1
CASUARINACEAE (II-Casuarinales)			
Casuarina 1	C,H	(0)	1,2
CELASTRACEAE (V-Celastrales)			
Euonymus 3	A;C,H	*	1,2,3
Maytenus 1	A:p;(C)	0	2
CHENOPODIACEAE (III-Caryophyllales)			
Atriplex 1	A:a,pi	0	1
Beta 1	A:a,p	0	1
CISTACEAE (IV-Violales)			
Cistus 1	C,H;S	+	1
CLETHRACEAE (IV-Ericales)			
Clethra 1	C,H	0	4
CLUSIACEAE (IV-Theales)			
Hypericum 1	A;C,H	0	1
CONVOLVULACEAE (VI-Solanales)			
Convovulus 2	A:pd	0	1,2
CORNACEAE (V-Cornales)			
Aucuba 1	I	0	1,2
Cornus 6	A;H;I	0	1,2,3,4
CRASSULACEAE (V-Rosales)			
Crassula 1	C,H	0	2
Sedum 1	A:pi;C,(H)	0	1
CUCURBITACEAE (IV-Violales)			
Citrullus 1		0	2
Cucumis 1	A	0	2
Marah 1	A	0	1
DIPSACACEAE (VI-Dipsacales)			
Dipsacus 1	A;I	0	1
EBENACEAE (IV-Ebenales)			
Diospyros 1	A;C,H	+	1,2,4
ELEAGNACEAE (V-Proteales)			
Elaeagnus 1	A:i;(C),H	0	3
Hippophae 1	A:i;C,H	+	3
Shepherdia 1	(C,H)	+	3

APPENDIX II continued.

ERICACEAE (IV-Ericales)			
Arbutus 2	C,H;I	+	1,2
Arctostaphylos 8	(C),H;I	+	1,2
Gaultheria 1	C,(H)	+	1,2
Gaylussacia 1	C,(H)	0	4
Kalmia 2	(C,H);0	0	4
Ledum 1	C,H	0	3
Lyonia 1	(C,H);0	0	4
Pieris 1	C,H;0	0	1
Rhododendron 6	A:pi;C;0;I	0	1,2,3,4
Vaccinium 7	C,(H);I	+	1,2,4
EUPHORBIACEAE (V-Euphorbiales)			
Anadrachne 1	C,(H)	0	3
Codiaeum 1	A;C,(H)	0	1
Euphorbia 1	A;C,H	0	1
FAGACEAE (II-Fagales)			
Castanea 3	(C),H	+	1,3,4
Fagus 4	A;C,H	+	1,3,4
Lithocarpus 1	(C,H)	+	1,2
Quercus 30	C,H	+	1,2,3,4
FUMARIACEAE (I-Papaverales)			
Dicentra 1	A:is	0	1
GARRYACEAE (V-Cornales)			
Garrya 1	A;I	0	1
GERANIACEAE (V-Geraniales)			
Pelargonium 3		0	1,3
GESNERIACEAE (VI-Scrophulariales)			
Saintpaulia 1		0	1
GROSSULARIACEAE (V-Rosales)			
Escallonia 2	C;I	0	1,2
Ribes 9	C,H	*	1,2,3,4
HAMAMELIDACEAE (II-Hamamelidales)			
Corylopsis 1	C,H	+	3
Hamamelis 1	C,H	+	4
Liquidambar 1	C,H;I	+	1,2,4
HIPPOCASTANACEAE (V-Sapindales)			
Aesculus 3	A:pi;C	0	1,2,3
HYDRANGEACEAE (V-Rosales)			
Hydrangea 1	A:q;C;I;R	0	1
Jamesia 1	(C)	+	3
Philadelphus 2	C	0	1,3
HYDROPHYLLACEAE (VI-Solanales)			
Hydrophyllum 1		0	1
JUGLANDACEAE (II-Juglandales)			
Carya 6	C,(H)	+	2,3,4
Juglans 4	A:pi;C,H	+	1,2,3,4
LAMIACEAE (VI-Lamiales)			
Ajuga 1	A;0;I	0	1
Coleus 1	0	0	1
Melissa 1	0	0	1
Origanum 1	A	0	1
Rosmarinus 1	A;0	0	2
Salvia 8	A;D	0	1,2

APPENDIX II continued.

LAURACEAE (I-Laurales)			
Cinnamomum 1	A:is;C;D;S	+	1,2
Laurus 1	A:is;C;S	0	2
Lindera 1	A:is;C;S	0	4
Persea 1	A;C	(0)	1,2
Sassafras 1	(C)	+	4
Umbellularia 1	A;C	0	1,2
LEGUMINOSAE (V-Fabales)			
Acacia 3	A:a,i,pi;C,H	*	1,2
Albizzia 1	A:a,i;(C),H	0	1
Calliandra 1	A;C,(H)	+	2
Ceratonia 1	A;C,(H)	0	1,2
Cercis 2	C,H	0	1,2
Cladastris 1	A:qz;C	0	3
Coronilla 1	A:qz;C,H	0	3
Cytisus 3	A:a,pi,pz,qz;(C,H)	0	1,2,3
Erythrina 1	A:i;C	0	2
Genista 1	A:pi,qz;(C,H)	0	2
Gleditsia 1	A:a,p,qz;C	0	1,3,4
Gymnocladus 1	(C)	0	4
Halimodendron 1	(C)	0	3
Laburnum 2	A:pz,qz;(C,H)	0	1,3
Lupinus 1	A:i,pi,qz;(C,H)	0	1
Medicago 1	A:pi,pd;(C,H)	0	1,2
Robinia 1	C,H	(0)	1,3,4
Spartium 1	A:qz;(C)	0	1,3
Wisteria 1	C	0	1,2
LIMNANTHACEAE (V-Geraniales)			
Limnanthes 1	C,(H);G	0	1
LOGANIACEAE (VI-Gentianales)			
Gelsemium 1	A:i	0	1,2
LYTHRACEAE (V-Myrtales)			
Lagerstroemia 1	A;H	(0)	1,2
MAGNOLIACEAE (I-Magnoliales)			
Liriodendron 1	A:is;(C);S	0	1,2,3,4
Magnolia 3	A:is;C;S	0	1,2,3
MALVACEAE (IV-Malvales)			
Abutilon 2	A;(C,H)	0	2
Althaea 1	A;(C)	+	3
Hibiscus 1	A;C	0	1,2
Lavatera 1	A;(C,H)	(0)	1,2
MELASTOMATACEAE (V-Myrtales)			
Tibouchina 1	A;C,H	0	1
MENISPERMACEAE (I-Ranunculales)			
Cocculus 1	A:i,is	0	2
MORACEAE (II-Urticales)			
Ficus 2	A:pd;C	0	1,2,3
Maclura 2	(C)	0	3,4
Morus 3	A:pi;(C)	0	1,3
MYOPORACEAE (VI-Scrophulariales)			
Myoporum 3	A;I	0	1,2
MYRICACEAE (II-Myricales)			
Myrica 3	A;C,H	+	1,2,4
MYRSINACEAE (IV-Primulales)			
Ardisia 1	C,H	0	1

APPENDIX II continued.

MYRTACEAE (V-Myrtales)			
Callistemon 2	A;C,H	0	1,2
Eucalyptus 17	C,H;S	*	1,2
Eugenia 1	A;C,H;S	0	2
Feijoa 1	C	0	2
Leptospermum 1	A;(C,H);S	0	2
Melaleuca 2	A;C,H;S	*	1,2
Myrtus 1	A;C,H	0	2
NYCTAGINACEAE (III-Caryophyllales)			
Bougainvillea 2	A;R	0	1,2
NYSSACEAE (V-Cornales)			
Davidia 1	(C),H;I	0	1
Nyssa 1	(C,H)	+	4
OLEACEAE (VI-Scrophulariales)			
Chionanthus 1		0	3
Fontanesia 2	A;I	0	3
Forsythia 2	A;I	0	1,3
Fraxinus 5	A;I	0	1,2,3,4
Jasminum 1	A;I	0	1
Ligustrum 5	A;I	0	1,2,3,4
Olea 2	A;I	0	1,2
Osmanthus 1	A;I	0	2
Ismarea 1		0	1
Syringa 2	A;I	0	1,3
ONAGRACEAE (V-Myrtales)			
Fuchsia 3	H;R	0	1,2,3
Oenothera 1	H;R	0	1
OXALIDACEAE (V-Geraniales)			
Oxalis 1	A;C,H	0	1
PAEONIACEAE (IV-Dilleniales)			
Paeonia 1		0	1
PAPAVERACEAE (I-Papaverales)			
Eschscholzia 1	A:is	0	1
Papaver 1	A:is	(0)	1
PIPERACEAE (I-Piperales)			
Peperomia 1	A;(C)	0	1
PITTOSPORACEAE (V-Rosales)			
Pittosporum 2	A;(C);S	0	1,2
PLANTAGINACEAE (VI-Plantaginales)			
Plantago 1	A;I	0	1
PLATANACEAE (II-Hamamelidales)			
Platanus 2	C,H	0	1,2,3,4
PLUMBAGINACEAE (III-Plumbaginales)			
Armeria 1	C,H	+	1
POLEMONIACEAE (VI-Solanales)			
Phlox 1	A	0	1
POLYGONACEAE (III-Polygonales)			
Eriogonum 6	C,(H)	0	1
Polygonon 1	A;C,H	0	1
Rumex 1	A:pi;C,H	0	1,2,4
PORTULACACEAE (III-Caryophyllales)			
Portulaca 1	A:a;(C)	0	1
PRIMULACEAE (IV-Primulales)			
Cyclamen 1	C,H	0	1,3
Primula 2	A;C,H	0	1,3

APPENDIX II continued.

PROTEACEAE (V-Proteales)			
Grevillea 2	A;C,H	0	1,2
Hakea 2	C,H	+	2
PUNICACEAE (V-Myrtales)			
Punica 1	A:pi;H	(0)	1,2
RANUNCULACEAE (I-Ranunculales)			
Aquilegia 1	A:is	0	1
Clematis 2	A	0	1,2
Delphinium 1	A:is	0	1
Helleborus 1	A	0	1
RHAMNACEAE (V-Rhamnales)			
Ceanothus 7	A;C,(H)	0	1,2
Rhamnus 5	C,H	*	1,2,3
ROSACEAE (V-Rosales)			
Amelanchier 5	C	+	1,2,3,4
Aronia 1	C	+	4
Chaenomeles 2	C	+	3
Chamaebatia 1	(C)	+	2
Cotoneaster 10	C	+	1,2,3
Crataegus 5	C	+	1,3,4
Cydonia 2	A;C	+	2,3
Eriobotrya 1	A;C	0	1
Exochorda 1	C	0	3
Geum 1	A;(C),H	0	1
Heteromeles 1	C	(0)	1,2
Holodiscus 1	(C)	0	1
ROSACEAE (V-Rosales) cont'd			
Kerria 1	C	+	3
Lyonothamnus 1	(C)	+	1,2
Malus 9	C	+	1,2,3,4
Mespilus 3	C	+	3
Oemleria 1	(C)	0	1
Photinia 3	C	+	1,2
Prunus 23	A:a,i,pi;C	*	1,2,3,4
Pyracantha 2	(C)	+	1,2,3
Pyrus 4	(C)	+	1,2,3,4
Raphiolepis 3	C	+	1,2
Rhodotypos 1	C	+	3
Rosa 7	C,H	+	1,3,4
Rubus 4	(C),H	*	1,2,3,4
Sorbaria 1	C	+	3
Sorbus 9	C	+	1,3,4
Spiraea 7	A;C	*	1,3,4
RUBIACEAE (VI-Rubiales)			
Coffea 1	A:p;C	0	1
Galium 1	A;(C);I;R	0	1
Gardenia 3	A;C;I	0	1,2
RUTACEAE (V-Sapindales)			
Choisya 1	A:qn;(C)	0	1
Citrus 3	A:a,is,pd,qn;(C);S	(0)	1,2
Skimmia 1	A:qn;(C)	0	1
SALICACEAE (IV-Salicales)			
Populus 10	C	*	1,2,3,4
Salix 17	C,H	+	1,2,3,4
SAPINDACEAE (V-Sapindales)			
Dodonea 1	A;C	0	2
SAXIFRAGACEAE (V-Rosales)			
Astilbe 1	C	0	1
Tolmiea 1	(C,H)	0	1

APPENDIX II continued.

SCROPHULARIACEAE (VI-Scrophulariales)			
Digitalis 1	A	0	1
Hebe 1	I	0	1,2
Mimulus 1	A	0	1
Nemesia 1		0	1
Veronica 1	A;I	0	1
SOLANACEAE (VI-Solanales)			
Lycopersicon 1	A:i,is,st	0	1
Petunia 1	A	0	1
Solanum 3	A:a,is,p,pi,st	0	1,2
STAPHYLEACEAE (V-Sapindales)			
Staphylea 3	C	0	3
STERCULIACEAE (IV-Malvales)			
Fremontodendron 2	C	+	1,2
STYRACACEAE (IV-Ebenales)			
Halesia 1	C	0	1
THEACEAE (IV-Theales)			
Camellia 2	A:p;C,H	0	1,2
Stewartia 1	C,H	+	1
THYMELAEACEAE (V-Myrtales)			
Daphne 1		0	1
TILIACEAE (IV-Malvales)			
Tilia 3	C	+	1,3,4
ULMACEAE (II-Urticales)			
Celtis 2	A;H	+	3,4
Ulmus 6	C	+	1,3,4
Zelkova 1	C	(0)	1
URTICACEAE (II-Urticales)			
Urtica 1	A:i,pi;(C)	0	1
VERBENACEAE (VI-Lamiales)			
Lantana 1	A;I	0	1
VIOLACEAE (IV-Violales)			
Viola 1	A:pi	0	1
VITACEAE (V-Rhamnales)			
Cissus 1	C,(H);R	0	1,2
Vitis 2	C,H;R	0	1,2,3,4

APPENDIX III. Index to common names of plants tested for gypsy moth host suitability (see Appendix I).

abelia, glossy	Abelia grandiflora
acacia, Bailey	Acacia baileyana
African daisy	Osteospermum fruiticosum
African violet	Saintpaulia ionantha
agrostemma, blood red	Lychnis coronaria
ajuga	Ajuga reptans
alder, red	Alnus rubra
alder, thinleaf	Alnus tenuifolia
alder, white	Alnus rhombifolia
alfalfa	Medicago sativa
almond, dwarf flowering	Prunus glandulosa
alpine currant	Ribes alpinum
American elm	Ulmus americana
American linden	Tilia americana
American marigold	Tagetes erecta
apple	Pyrus malus
apricot, Tilton	Prunus persica
arabis, snowcap	Arabis sp.
aralia, Japanese	Fatsia japonica
ardisia	Ardisia japonica
ash, Oregon	Fraxinus latifolia
aspen, quaking	Populus tremuloides
astrid peperomia	Peperomia obtusifolia
aucuba, Japanese	Aucuba japonica
avocado, zutano	Persea americana
azalea	Rhododendron sp.
Bailey acacia	Acacia baileyana
bajazzo rose	Rosa sp.
bamboo, heavenly	Nandina domestica
banyan, weeping Chinese	Ficus benjamena
Barbara Karst	Bougainvillea x buttiana
barberry, William Penn	Berberis gladwynnsis
beech, European	Fagus sylvatica
beefwood, coast	Casuarina stricta
begonia, rex	Begonia sp.
begonia, wax	Begonia sp.
bellflower	Campanula sp.
berry, lingon	Vaccinium vitis-idaea minus
big-leaf maple	Acer macrophyllum
bigleaf hydrangea	Hydrangea macrophylla
bigroot	Marah oreganus
birch, cut-leafed weeping	Betula pendula
birch, European white	Betula verrucosa
bishop's hat	Epimedium rubrum
bittersweet	Solanum dulcamara
black cottonwood	Populus trichocarpa
black currant	Ribes sp.
black locust	Robinia pseudoacacia
black walnut	Juglans nigra
blackberry, Himalayan	Rubus discolor
bleeding heart, common	Dicentra spectabilis
blood red agrostemma	Lychnis coronaria
blue oak	Quercus Douglasii
blue potato vine	Solanum rantonnetii
blueberry	Vaccinium corymbosum
blueberry, red	Vaccinium parvifolium
bottlebrush, lemon	Callistemon citrinus
boxelder	Acer negundo
boxwood, common	Buxus sempervirens
broom, Scotch	Cytisus scoparius
broom, Spanish	Spartium juncium
buckeye, California	Aesculus californica
buckwheat, red	Eriogonum grande
Burgundy gaillardia	Gaillardia aristata
butterfly bush	Buddleja alternifolia
cabbage	Brassica oleracea
cabernet savignon	Vitis vinifera
cactus, rose	Pereskia grandifolia

APPENDIX III continued.

California buckeye	Aesculus californica
California dutchman's pipe	Aristolochia californica
California glory	Fremontodendron californicum
California laurel	Umbellularia californica
California peppertree	Schinus molle
California poppy	Eschscholzia californica
California red oak	Quercus kelloggii
California sycamore	Platanus racemosa
camellia	Camellia japonica
camphor tree	Cinnamonum camphora
candytuft	Iberis sp.
canyon live oak	Quercus chrysolepis
Carmel creeper	Ceanothus griseus
carnation	Dianthus caryophilus
carob	Ceratonia siliqua
Carolina jessamine	Gelsemium sempervirens
cascara	Rhamnus purshiana
Catalina ironwood	Lyonothamnus floribundus
catalpa, northern	Catalpa speciosa
chain tree, golden	Laburnum watereri
cherry, hollyleaf	Prunus illicifolia x lyoni
chestnut, horse	Aesculus lippocastanum
chestnut, Spanish	Castanea sativa
Chinese elm	Ulmus parvifolia
Chinese hibiscus	Hibiscus rosa-sinensis
chokecherry, common	Prunus salicina
chrysanthemum, florist's	Chrysanthemum morifolium
cider gum	Eucalyptus gunnii
Clary sage	Salvia sclarea
cleavers	Galium aparine
clematis, western	Clematis liguticifolia
climbing rose	Rosa sp.
coast beefwood	Casuarina stricta
coast live oak	Quercus agrifolia
coffee	Coffea arabica
coffeeberry	Rhamnus californica
coleus	Coleus hybridus
columbine	Aquilegia sp.
common bleeding heart	Dicentra spectabilis
common boxwood	Buxus sempervirens
common chokecherry	Prunus salicina
common dandelion	Taraxacum officinale
common foxglove	Digitalis purpurea
common garden petunia	Petunia hybrida
common geranium	Pelargonium hortorum
common heliotrope	Heliotropium arborescens
common lilac	Syringa vulgaris
common manzanita	Arctostaphylos manzanita
common snowberry	Symphoricarpos albus
common teasel	Dipsacus sylvestris
common thyme	Thymus vulgaris
common weigela	Weigela florida
concord grape	Vitis vinifera
corkscrew willow	Salix babylonica
cotoneaster, rock	Cotoneaster horizontalis
cottonwood, black	Populus trichocarpa
cottonwood, Fremont	Populus Fremontii
cowslip lungwort	Pulomonaria angustifolia
coyote bush	Baccharis pilularis
creeping phlox	Phlox subulata
crepe myrtle	Lagerstroemia indica
crossandra	Crossandra infundibuliformis
croton	Codiaeum aucubaefolium
crown of thorns	Euphorbia milii
curly dock	Rumex crispus
currant, alpine	Ribes alpinum
currant, black	Ribes sp.
cut-leafed weeping birch	Betula pendula
cyclamen, florist's	Cyclamen persicum
daisy, African	Osteospermum fruiticosum
dandelion, common	Taraxacum officinale
daphne, winter	Daphne odora

APPENDIX III continued.

deer brush	Ceanothus integerimus
desert gum	Eucalyptus rudis
devil's walking stick	Aralia spinosa
dogwood, flowering	Cornus florida
dogwood, red-osier	Cornus stolonifera
donkeytail	Sedum morganianum
dwarf blue gum	Eucalyptus globulus
dwarf flowering almond	Prunus glandulosa
dwarf mix	Nemesia strumosa
dwarf periwinkle	Vinca minor
eastern redbud	Cercis canadensis
elm, America	Ulmus americana
elm, Chinese	Ulmus parvifolia
empress tree	Paulownia tomentosa
Engelmann oak	Quercus engelmanii
English holly	Ilex aquifolium
English ivy	Hedera helix
English laurel	Prunus laurocerasus
escallonia, pink	Escallonia laevis
eucalyptus, silver dollar	Eucalyptus cinerea
euonymus, evergreen	Euonymus japonica
European beech	Fagus sylvatica
European filbert	Corylus avellana
European mountain-ash	Sorbus aucuparia
European white birch	Betula verrucosa
evergreen euonymus	Euonymus japonica
false aralia, threadleaf	Dizygotheca elegantissima
false spiraea	Astilbe japonica
fernleaf yarrow	Achillea filipendula
field morning glory	Convolvulus arvensis
fig, Old Mission	Ficus carica
filbert, European	Corylus avellana
fire thorn	Pyracantha coccinea
florists' chrysanthemum	Chrysanthemum morifolium
florists' cyclamen	Cyclamen persicum
flowering dogwood	Cornus florida
forget-me-not	Myosotis sylvatica
forsythia	Forsythia intermedia
foxglove, common	Digitalis purpurea
Fremont cottonwood	Populus fremontii
fruitless mulberry	Morus alba
fuchsia, hybrid	Fuchsia hybrida
gaillardia, burgundy	Gaillardia aristata
gardenia	Gardenia jasminoides
geranium, common	Pelargonium hortorum
globe thistle	Echinops exaltatus
glossy abelia	Abelia grandiflora
glossy privet	Ligustrum lucidum
gold flower	Hypericum moserianum
golden chain tree	Laburnum watereri
golden weeping willow	Salix alba tristis
grape ivy	Cissus rhombifolia
grapefruit, marsh	Citrus paradisi
grape, Cabernet Savignon	Vitis vinifera
grape, Thompson's seedless	Vitis vinifera
grape, Concord	Vitis vinifera
grape, shining Oregon	Berberis aquifolium
grevillea	Grevillea 'noellii'
gum, cider	Eucalyptus gunnii
gum, desert	Eucalyptus rudis
gum, dwarf blue	Eucalyptus globulus
gum, red	Eucalyptus camaldulensis
gum, silver dollar	Eucalyptus cinerea
hairy manzanita	Arctostaphylos columbiana
Hawaiian elf schefflera	Schefflera arboricola
hawthorn, India	Raphiolepsis indica
hawthorn, Indian	Raphiolepsis ballevira
hawthorn, one-seed	Crateagus monogyna
hazelnut, western	Corylus californica
heavenly bamboo	Nandina domestica
heavenly white nectarine	Prunus lyoni
hebe	Hebe anomala

APPENDIX III continued.

heliotrope, common	Heliotropium aborescens
hibiscus, Chinese	Hibiscus rosa-sinensis
Himalayan blackberry	Rubus discolor
hollyleaf cherry	Prunus illicifolia x lyoni
holly, English	Ilex aquifolium
honey locust	Gleditsia triacanthos
hops	Humulus lupulus
horse chestnut	Aesculus hippocastanum
hybrid fuchsia	Fuchsia hybrida
hydrangea, bigleaf	Hydrangea macrophylla
ice plant, trailing	Lampranthus spectabilis
India hawthorn	Raphiolepsis indica
Indian hawthorn	Raphiolepsis ballevira
Indian plum	Oemleria cerasiformis
interior live oak	Quercus wislizenii
ironbark, red	Eucalyptus sideroxylon
ironbark, white	Eucalyptus leucoxylon
ironwood, Catalina	Lyonothamnus floribundus
ivy, grape	Cissus rhombifolia
ivy, English	Hedera helix
Japanese aralia	Fatsia japonica
Japanese aucuba	Aucuba japonica
Japanese photinia	Photinia glabra
Japanese privet	Ligustrum japonicum
Japanese wisteria	Wisteria floribunda
jasmine, winter	Lasminum nudiflorum
jessamine, Carolina	Gelsemium sempervirens
kinikinnic	Arctostaphylos uva-ursi
kiwi	Actinidia chinensis
knotweed	Polygonum sp.
Lady Washington pelargonium	Pelargonium domesticum
lantana	Lantana montevidensis
larkspur	Delphinium elatum
larch, European	Larix decidua
laurel, California	Umbellularia californica
laurel, English	Prunus laurocerasus
leatherleaf viburnum	Viburnum rhytidophyllum
lemon balm	Melissa officinalis
lemon bottlebrush	Callistemon citrinus
lemon, Meyer	Citrus lemoni
lenten rose	Helleborus orientalis
lilac melaleuca	Melaleuca decussata
lily-of-the-valley	Pieris japonica
lilac, common	Syringa vulgaris
lingon berry	Vaccinium vitis-idaea minus
linden, American	Tilia americana
linden, little leaf	Tilia cordata
lithospermum	Lithodora diffusa
little-leaf linden	Tilia cordata
lobelia	Lobelia erinus
locust, black	Robinia pseudoacacia
locust, honey	Gleditsia triacanthos
Lombardy poplar	Populus nigra 'italica'
loquat	Eriobotrya japonica
lungwort, cowslip	Pulomonaria angustifolia
lupine, Russell hybrid	Lupinus 'Russell hybrids'
madrone	Arbutus menziesii
magnolia, rustica rubra	Magnolia soulangiana
mallow	Malva neglecta
manzanita, common	Arctostaphylos manzanita
manzanita, hairy	Arctostaphylos columbiana
manzanita, vine hill	Arctostaphylos densiflora
maple, bigleaf	Acer macrophyllum
maple, vine	Acer circinatum
maple, Norway	Acer platanoides
marjoram	Origanum majorana
marsh grapefruit	Citrus paradisi
marigold, American	Tagetes erecta
marguerite, yellow	Chrysanthemun frutescens
meadow foam	Limnanthes x alba
melaleuca, lilac	Melaleuca decussata
Mexican orange	Choisya ternata

APPENDIX III continued.

Meyer lemon	Citrus limoni
mock orange	Philadelphus sp.
mon cheri	Rosa sp.
Montana blue	Centauria cyanus
Monterey carpert	Arctostaphylos hookeri
monkey flower, Plumas	Mimulus bifidus
morning glory, field	Convolvulus arvensis
moss, rose	Portulaca grandiflora
mountain stewartia	Stewartia ovata
mountain ash, European	Sorbus aucuparia
Mrs. Bradshaw	Geum quellyon
mulberry, fruitless	Morus alba
myoporum, Putah Creek	Myoporum parviflorum
myrtle, crepe	Lagerstroemia indica
navel orange	Citrus sinensis
nettle, stinging	Urtica dioica
northern catalpa	Catalpa speciosa
Norway maple	Acer platanoides
oak, blue	Quercus Douglasii
oak, California red	Quercus kelloggii
oak, canyon live	Quercus chrysolepis
oak, coast live	Quercus agrifolia
oak, Engelmann	Quercus Engelmanii
oak, interior live	Quercus wislizenii
oak, Oregon white	Quercus garryana
oak, poison	Rhus diversiloba
oak, red	Quercus rubra
oak, silk	Grevillea robusta
oak, tan	Lithocarpus densiflorus
oak, valley	Quercus lobata
ocean spray	Holodiscus discolor
old mission fig	Ficus carica
oleander	Nerium oleander
olive	Olea europaea
one-seed hawthorn	Crataegus monogyna
orange, Mexican	Choisya ternata
orange, mock	Philadelphus sp.
orange, navel	Citrus sinensis
orange, Valencia	Citrus sinensis
Oregon ash	Fraxinus latifolia
Oregon white oak	Quercus garryana
oriental poppy	Papaver orientale
osmarea	Osmarea burkwoodii
oval-leafed viburnum	Viburnum ellipticum
oxalis	Oxalis regnellii
Pacific waxmyrtle	Myrica californica
pansy, tricolor	Viola wittrockiana
peach	Prunus persica
pear	Pyrus communis
pelargonium, Lady Washington	Pelargonium domesticum
peony	Paeonia albiflora
peppermint	Mentha piperita
peperomia, astrid	Peperomia obtusifolia
peppertree, California	Schinus molle
peppermint, white	Eucalyptus pulchella
persimmon	Diospyros virginiana
periwinkle, dwarf	Vinca minor
petunia, common garden	Petunia hybrida
phlox, creeping	Phlox subulata
photinia, Japanese	Photinia glabra
piggy-back plant	Tolmiea menziesii
pineapple weed	Matricaria matricarioides
pink escallonia	Escallonia laevis
pistachio	Pistacia vera
PJM rhododendron	Rhododendron sp.
plantain	Plantago lanceolata
Plumas monkey flower	Mimulus bifidus
plum, Indian	Oemlaria cerasiformis
plum, Santa Rosa	Prunus persica
poison oak	Rhus diversiloba
polyanthus primula	Primula polyantha
pomegranate, 'wonderful'	Punica granatum

APPENDIX III continued.

poplar, Lombardy	Populus nigra 'italica'
poppy, California	Eschscholzia californica
poppy, Oriental	Papaver orientale
potato vine	Solanum jasminoides
potato vine, blue	Solanum rantonnetti
princess flower	Tibouchina urvilleana
privet, glossy	Ligustrum lucidum
privet, Japanese	Ligustrum japonicum
privet, Vicary golden	Ligustrum 'Vicaryi'
purple sage	Salvia leucophylla
pussy willow	Salix discolor
Putah creek myoporum	Myoporum parvifolium
quail bush	Atriplex lentiformis
quaking aspen	Populus tremuloides
radish	Raphanus sp.
ragwort, tansy	Senecio jacobae
raspberry, red	Prunus virginiana
red alder	Alnus rubra
red blueberry	Vaccinium parvifolium
red buckwheat	Eriogonum grande
red gum	Eucalyptus camaldulensis
red ironbark	Eucalyptus sideroxylon
red oak	Quercus rubra
red raspberry	Rubus sp.
red-osier dogwood	Cornus stolonifera
redbud, eastern	Cercis canadensis
redbud, western	Cercis occidentalis
redwood, dawn	Metasequoia glyptostroboides
rex begonia	Begonia sp.
rhododendron, PJM	Rhododendron sp.
rock cotoneaster	Cotoneaster horizontalis
rock rose	Cistus carbariensis
rose cactus	Pereskia grandifolia
rose moss	Portulaca grandiflora
rose, climbing	Rosa sp.
rose, lenten	Helleborus orientalis
rose, mon cheri	Rosa sp.
rose, show biz	Rosa sp.
royal blue speedwell	Veronica teucrium
Russell lupine	Lupinus Russell Hybrids
rustic colors	Rudbeckia hirta
sage	Salvia officinalis
sage, Clary	Salvia sclarea
sage, purple	Salvia leucophylla
sage, sandhill	Artemesia pycnocephala
salal	Gaultheria shallon
salmonberry	Rubus spectabilis
sandhill sage	Artemisia pycnocephala
Santa Rosa plum	Prunus persica
sawleaf zelkova	Zelkova serrata
schefflera, Hawaiian elf	Schefflera arboricola
Scotch broom	Cytisus scoparius
scouler willow	Salix scouleriana
sea pink	Armeria maritima
sequoia, giant	Sequoiadendron gigantea
serviceberry	Amelanchier alnifolia
shining Oregon grape	Berberis aquifolium
show biz	Rosa sp.
silk oak	Grevillea robusta
silk tree	Albizzia julibrissin
silk-tassel	Garrya fremontii
silver bell	Halesia carolina
silver dollar eucalyptus	Eucalyptus cinerea
silver dollar gum	Eucalyptus polyanthemos
skimmia	Skimmia japonica
smoke tree	Cotinus coggygria
snowberry, common	Symphoricarpos albus
snowcap arabis	Arabis sp.
Spanish broom	Spartium junceum
Spanish chestnut	Castanea sativa
spiraea, false	Astilbe japonica
St. Catherine's Lace	Eriogonum giganteum

APPENDIX III continued.

staghorn sumac	Rhus typhina
stewartia, mountain	Stewartia ovata
stinging nettle	Urtica dioica
strawberry tree	Arbutus unedo
sulfur flower	Eriogonum umbellatum
sumac, staghorn	Rhus typhina
sweet gum	Liquidambar styraciflua
sweetbrier	Rosa eglanteria
Swiss chard	Beta vulgaris
sycamore, California	Platanus racemosa
Sydney golden wattle	Acacia longifolia
tan oak	Lithocarpus densiflorus
tangerine	Citrus sinensis
tansy ragwort	Senecio jacobae
teasel, common	Dipsacus sylvestris
thimbleberry	Rubus parviflorus
thinleaf alder	Alnus tenuifolia
thistle, globe	Echinops exaltatus
Thompson's seedless grapes	Vitis vinifera
threadleaf false aralia	Dizygotheca elegantissima
thyme, common	Thymus vulgaris
tilton apricot	Prunus persica
tobira	Pittosporum tobira
tomato	Lycopersicon esculentum
touch-me-not	Impatiens sp.
toyon	Heteromeles arbutifolia
trailing ice plant	Lampranthus spectabilis
tree mallow	Lavatera assurgentiflora
tricolor pansy	Viola wittrockiana
tulip tree	Liriodendron tulipifera
twinberry	Lonicera involucrata
valencia orange	Citrus sinensis
valley oak	Quercus lobata
vetch	Vicia sp.
viburnum, leatherleaf	Viburnum rhytidophyllum
viburnum, oval-leaf	Viburnum ellipticum
Vicary golden privet	Ligustrum 'Vicaryi'
vine hill manzanita	Arctostaphylos densiflora
vine maple	Acer circinatum
violet, African	Saintpaulia ionantha
walnut, black	Juglans nigra
waterleaf	Hydrophyllum occidentale
wax begonia	Begonia sp.
waxmyrtle, Pacific	Myrica californica
weeping chinese banyan	Ficus benjamina
weigela, common	Weigela florida
western clematis	Clematis ligusticifolia
western hazelnut	Corylus cornuta
western redbud	Cercis occidentalis
white alder	Alnus rhombifolia
white ironbark	Eucalyptus leucoxylon
white peppermint	Eucalyptus pulchella
wild lilac	Ceanothus 'Ray Hartman'
wild lilac	Ceanothus sp.
William Penn barberry	Berberis gladwynnsis
willow, corkscrew	Salix babylonica
willow, golden weeping	Salix alba tristis
willow, pussy	Salix discolor
willow, Scouler	Salix scouleriana
winter daphne	Daphne odora
winter jasmine	Jasminum nudiflorum
wisteria, Japanese	Wisteria floribunda
yarrow	Achillea tomentosa
yarrow, fernleaf	Achillea filipundula
yellow marguerite	Chrysanthemum frutescens
zutano avocado	Persea americana