Phenotypic Selection in Impatiens pallida and Impatiens capensis.

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A Thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Masters of Science.

Abstract

Selection analysis involving a set of quantitative traits was conducted in natural populations of Impatiens capensis and I. pallida to determine whether: (1) selection is spatially heterogeneous; and (2) date of seedling establishment and size at first reproduction are under stabilizing selection. Twenty-five of 96 different estimates of directional selection were significantly different from zero. There was only one instance in which directional selection of a quantitative trait was spatially heterogeneous within a species. Taken together with the fact that quadrats within species were consciously placed in environmentally similar locations, the discovery of a very low level of spatially heterogeneous selection supports the finding of Stewart and Schoen (1987) that spatially heterogeneous selection in these species is likely due to environmental heterogeneity in the habitat. This study also revealed that stabilizing selection was generally weak, and the stabilizing selection estimates did not support the a priori expectation that certain life history characters would be under stabilizing selection. All of the characters examined showed significant among-family variation, suggesting that forces capable of maintaining genetic variation are acting within the populations.

Résumé

J'ai analysé la sélection d'un ensemble de caractères quantitatifs dans des populations naturelles d'Impatiens capensis et d'I. pallida afin d'établir: (1) si la sélection est spatialement hétérogène; et (2) si la date d'établissement des semis et la taille à la première reproduction subissent une pression de sélection stabilisatrice. Vingt-cinq des 96 estimés de sélection directionnelle différaient significativement de zéro, mais la sélection directionelle d'un caractère quantitatif n'etait spatialement hétérogène que dans un seul cas. Considérant que les quadrats de chaque espèces ont été choisis expressément dans des sites à l'environnement similaire, la découverte d'un très bas niveau d'hétérogénéité spatiale de la sélection corroboré les observations de Stewart et Schoen (1987), selon lesquelles l'hétérogénéité spatiale de la sélection est probablement due à l'hétérogénéité environnementale de l'habitat. La présente étude montre aussi que la sélection stabilisatrice est généralement faible. Les estimés de sélection stabilisatrice n'appuient pas l'hypothèse a priori selon laquelle certains caractères de l'histoire naturelle subiraient une pression de sélection stabilisatrice. En plus des résultats de l'analyse de la sélection, la présente étude montre une variation inter-famille significative pour tous les caractères étudiés, ce qui suggère que des forces capables de maintenir la variation génétique agissent à l'intérieur des populations.

Preface

As permitted by the regulations of the Faculty of Graduate Studies and Research, this thesis is composed of one article to be submitted for publication with the co-authorship of my supervisor, D. J. Schoen. I am first author and primarily responsible for the content and presentation of the paper.

Acknowledgements

I thank my supervisor, Dr. D. J. Schoen, whose support helped overcome problems incurred during the study, and especially for his help on initial drafts of this thesis. I am also grateful to the many people, students and staff, who have influenced and contributed to the various facets of my graduate training. I thank the Gault Board for allowing me to conduct research at the Mont St-Hilaire Research Station, and I thank all those with whom I shared the facilities for their enthusiasm and friendship. I thank Hélène Lair for providing the French translation of the abstract. I also received a wealth of support and encouragement from my family; Roger, Carmela, Louise, Derek, Laurel, Marc, Elizabeth, and Kathline.

The study was supported by the operating grant to Dr. D. J. Schoen from the Natural Science and Engineering Research Council of Canada.

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INTRODUCTION

Since evolution requires heritable variation, the maintenance of variation is of major concern to evolutionary biologists. Selection is one of several factors which can contribute to the regulation of variation. The maintenance of genetic variability by spatially heterogeneous selection was first modelled by Levene (1953). He demonstrated that in a one-locus two-allele system a polymorphism would be maintained if the weighted harmonic mean fitness of each homozygote is less than 1 (i.e. $\sum c_x/v_x < 1$ and $\sum c_x/w_x < 1$, where v_x and w_x are the fitnesses of the two homozygotes relative to the heterozygote in environment x, and c_x is the proportion of the population in environment x). Dominance of one allele (Prout, 1968), habitat selection (Maynard Smith, 1966), limited gene dispersal, switching dominance (where either the most or least fit allele is always dominant) (Gillespie, 1978), and soft versus hard selection (Dempster, 1955) also can influence the maintenance of polymorphism. For polymorphic traits, whether heterogeneous selection maintains genetic variation depends on the difference in fitness between genotypes in each environment, the extent of gene dispersal, the strength of linkage disequilibrium between loci coding for the traits, and the size of each sub-population (Felsenstein, 1976).

A single genotype may differ phenotypically when grown in a range of different environments. This effect of the environment on the phenotype has been called phenotypic plasticity (Bradshaw, 1965; Schlichting, 1986). Moreover, the phenotypic response of a given genotype to a range of environmental conditions, i.e. its norm of reaction, may differ significantly from those of other genotypes. Such genotype by environment interaction represents genetic variability in plastic response. Via and Lande (1985) have shown that under certain conditions, given variability in plastic response, weak spatially heterogeneous selection will promote the evolution of an optimum norm of reaction. This will decrease genetic variability. Spatially heterogeneous selection can be viewed, therefore, as playing a role both in the maintenance of genetic variation and in the evolution of phenotypic plasticity.

The use of reciprocal transplant experiments has been proposed to indirectly determine whether genotypic differences between locations are the result of selection (Ennos, 1983). This could be done by measuring the mean success of individuals transplanted into the different locations. Spatially heterogeneous selection would be implied if the resident plants of each location preform best in those locations. Such transplant experiments, however, cannot provide fine scale information about selection since they deal with the mean success of groups. They may also be biased since transplant studies usually choose to examine only habitats which appear different (Clausen, 1951). In order to test the assumed role of selection in the maintenance of genetic variability, the direct measurement of selection in nearby locations is invaluable (Kalisz, 1986; Stewart and Schoen, 1987).

Studies of stabilizing (or disruptive) selection are also of interest since this mode of selection can promote the erosion of variation. A number of plant life history characters are expected a priori to be under stabilizing selection. These include the size (or age) when reproduction begins, and the timing of seed germination. Cohen (1971) and Paltridge and Denholm (1974) have built models based on simple trade-offs between plant size and the time remaining for growth and reproduction. These models predict plants should have a single complete switch from vegetative to reproductive investment. King and Roughgarden (1982a, 1982b) expanded these models to include two specific ecological features, namely growing seasons of variable length, and herbivory. They show that if the length of the growing season is unpredictable, the optimal strategy will be a gradual switch between vegetative and reproductive investment, and moreover, that if plants are at risk of damage due to herbivory following the initiation of reproduction, the optimum strategy will be one which allows a switch back to vegetative growth. In general, according to these models, plants which initiate reproduction either before or after the optimum will have decreased fecundity. The age (or size) when reproduction is initiated should, therefore, be under stabilizing selection.

The expectation that germination date will be under stabilizing selection is based on empirical observations that survival and fecundity are often influenced by the timing of germination. For example, Howell (1981) and Baskin and Baskin (1972) found that early germinating plants had above average mortality rates. Arthur and Lawrence (1973), on the other hand, report that plants germinating in the fall of some years suffered 100% mortality, whereas mortality among spring-germinating individuals was relatively low. Cook (1980) also found that late-emerging plants of Viola blanda had increased mortality, and Marks and Prince (1981) found that high mortality occurred in both early- and late-germinating individuals of Lacuca serriola. The effect of germination date on fecundity is more clear cut. Since the length of the period of growth may ultimately determine the size of a plant, and large plants are more fecund, early germinating individuals should in theory have higher fecundity (Naylor, 1972). This has been reported in several species, including Dactylis glomerata, Impatiens capensis, Teesdalia nudicaulis, Lactuca serriola, Leavenworthia stylosa, and Papaver dubium (Ross and Harper, 1972; Howell, 1981; Newman, 1964; Marks and Prince, 1981; Baskin and Baskin, 1972; Arthur and Lawrence, 1973).

The two questions I address in this thesis concern the role of selection in regulating variation in populations. The first question is whether directional selection is spatially heterogeneous. This question is relevant to the maintenance of genetic variation in populations. The second question is whether plant size, measured at the initiation of reproduction, and date of seedling establishment, are under stabilizing selection. This question is also relevant to the maintenance of genetic variation, since stabilizing selection can, as outlined above, lead to the erosion of variation. Answers to these questions come from demographic data which are used to estimate selection of a number of morphological and life history characters in the annual plant species Impatiens pallida and I. capensis. The estimates of selection are also supplemented with estimates of heritability of the morphological and life history characters in I. pallida.

While this thesis cannot unambiguously reveal the role of selection in the regulation of diversity in populations, it contributes to a better understanding of the spatial heterogeneity of selection in nature, and therefore sheds light on the possible role of selection in maintaining genetic variability within populations. A comprehensive study would require the examination of more sites and species, measurement of gene flow and mating system, more accurate estimation of heritability, estimation of genetic covariance among characters, and measurements of the correlation among the phenotypes of a genotype in different environments (Via and Lande, 1985). This thesis is, however, a step towards such a complete understanding of the role selection plays in natural populations.

MATERIALS AND METHODS

Study Organism and Study Sites.

Impatiens pallida and *I. capensis* are obligate annuals which commonly occur in the understory of forests in eastern North America. Although they are sympatric, their microscale distributions are sharply delineated by soil moisture (Russel, 1976). *Impatiens capensis* is predominant in stream beds and hollows, while *I. pallida* often occupies nearby drier regions. Both species form large, dense, monospecific stands at the Mont St-Hilaire Research Station (Maycock, 1961). Estimates of selection were obtained in two quadrats of each species. Seeds of individuals from a third quadrat of *I. pallida* were used to estimate the heritability of the traits under study. The *I. capensis* quadrats were located within a stream bed, and the *I. pallida* quadrats were located on an adjacent hillside. Within each species, the quadrats were placed in locations which were relatively homogeneous in plant density, soil moisture, and canopy light penetration. The quadrats were 20 cm wide by 190 - 250 cm in length. They were established from April 27-30, 1987. Each quadrat initially contained 250 tagged plants.

Longitudinal Data Collection.

Demographic and morphological data were collected from plants in all four quadrats during the summer of 1987. Monitoring began on 2 May 1987. Up until 1 June the quadrats were examined every two days. During this period, mortality, date of establishment (the date that the first true leaf exceeded 1.5 cm in length), and cotyledon area on the date of establishment were recorded. Cotyledon area was estimated as the sum of the product of the maximum width and length of both cotyledons. If both cotyledons were missing (due to abscission or predation) the plant was deleted from the data (7.9 %, 6.8 %, and 85.3 % of plants had 0, 1, and 2 cotyledons on the date of establishment). Treating missing cotyledons as having a length and width of zero did not cause any qualitative differences in the results. If only one cotyledon was present, the cotyledon area was estimated as double the product of the length and width of the one cotyledon. After 1 June quadrats were monitored weekly. Mortality continued to be recorded, and several indices of plant size and characters associated with reproduction were also measured. These included the number of leaves, number of nodes, stem diameter, plant height, the date flower buds were first observed, number of newly produced chasmogamous flowers, number of newly produced cleistogamous fruits greater than 0.5 cm in length, and number of newly produced chasmogamous fruits greater that 1.0 cm. In recording the presence of new fruits, different minimum size criteria were used for the two fruit types because, at maturity, cleistogamous fruits are typically smaller than chasmogamous fruits. From each of the size measurements (i.e. number of nodes, number of leaves, stem diameter, and plant height) the relative growth rate (RGR) over a three week period was determined. These were calculated as $(\ln s_2 - \ln s_1) / (t_2 - t_1)$, where s_i was the size on week t_i (t_1 and t_2 were the week of June 6 and June 27 respectively). Table 1 lists the traits for which directional selection estimates were obtained. In many plants the evolution of life history events may be a function of individual size rather than age (Werner and Caswell, 1977). Because the number of degrees of freedom required to estimate stabilizing (or disruptive) selection gradients increases exponentially with the number of characters examined (sample size must exceed $n + [n(n+1)]/2$, where n is the number of characters), I have not included the morphological characters in the analysis (Lande and Arnold, 1983). Therefore, only the date of establishment, the number of nodes on DFFB, the number of leaves on DFFB, the stem diameter on DFFB, and the plant height on DFFB were included in the estimation of stabilizing (or disruptive) selection gradients.

This study focused on three non-overlapping episodes in the life cycle of Impatiens capensis and I. pallida. The first episode was defined as the period from establishment to the production of the first flower bud, the second episode from the production of the first flower bud to the production of the first fruit, and the third episode from the production of the first fruit to 18 September (close to the date of the first hard frost at Mont St. Hilaire). The first episode, therefore, involves selection of juveniles, the second, selection of pre-fruiting individuals, and the third, selection of fruiting individuals. Juveniles were assigned an absolute fitness of 0 if they died before producing flower buds and 1 if they survived to this stage. Pre-fruiting plants were assigned an absolute fitness of 0 if they died before producing a fruit and 1 if they survived to produce a fruit. Fruiting plants were assigned an absolute measure of fitness equivalent to the total number of fruits they produced (cleistogamous plus chasmogamous). Since the episodes are sequential, plants that died before the beginning of an episode were excluded from the analyses of that and subsequent episodes. For example, although 250 plants were initially tagged in each quadrat, not all survived to the beginning of the juvenile stage (defined as seedling establishment), so fewer individuals per quadrat were studied for the analysis of selection in the juvenile stage of the life cycle.

The absolute fitness of each individual i in episode k, W_{ik}, was transformed to relative fitness, w_{ik}, by dividing by the mean absolute fitness in that episode, $\overline{W}_k$ (where $\overline{W}_k = \Sigma W_{ik}/n_k$ and n_k is the number of individuals in episode k). So that selection estimates could be compared between the quadrats and among characters, the distributions of the characters and relative fitnesses were standardized by subtracting the mean and dividing by the standard deviation before estimating selection. This was done separately in each episode since the character distributions change between episodes and different measures of relative fitness were used in each.

Statistical Analysis of Selection.

Estimates of selection were calculated using the multivariate regression approach described by Arnold and Wade (1984a, 1984b). The technique provides estimates of selection simultaneously for several characters. Each estimate reflects only the direct selection on one character with the indirect effects of correlations among the characters removed. These estimates, called selection gradients, are distinct from those that reflect both direct and indirect influences on the distribution of a character, called selection differentials. Directional selection gradients were estimated as the partial regression coefficients from the linear multiple regression of fitness on the characters. The stabilizing (or disruptive) selection gradients were estimated as the partial regression parameters from the quadratic multiple regression of fitness on the characters. The statistical package FREESTAT, obtained from Thomas Mitchell-Olds, was used for resampling and calculation of jackknife derived standard errors for the estimated directional selection gradients. These standard errors are robust with respect to non-normality and heteroscedacity in the data (Mitchell-Olds and Shaw, 1987). Parametric estimates of standard errors from the regression analysis did not differ qualitatively from those obtained by the jackknifing procedure. To save on computing time and cost, only the parametric estimates of standard errors were calculated in the estimation of stabilizing (or disruptive) selection gradients. Estimates with non-overlapping 95% confidence intervals were consider to be significantly different from one another.

Environmental Monitoring.

Gravimetric soil moisture and solar irradiation were measured at each quadrat. Every three weeks throughout the summer, three 10 cm deep soil cores (diameter 4 cm) were collected at random from within 30 centimeters of each quadrat. The soil samples were weighed fresh, and after drying at 105 °C for 24 hours. Soil moisture is expressed below as the (g water / g wet weight) X 100 (Ball, 1986).

Irradiation was estimated by mounting stacks of diazochrome film horizontally just above the Impatiens canopy for 24 hr. Similar film stacks were placed in an open field receiving full sunlight. The film was developed in ammonia, and the amount of irradiation was taken to be proportional to the number of film layers exposed to light. The amount of irradiation in the four study quadrats was expressed as a percentage of the exposure in full sunlight (Friend, 1961). Irradiation was measured in four trials made in late August, with three replicates per trial. Analysis of variance was used to evaluate the effect of date, species, and location within species on both the soil moisture and irradiation. Means were compared using the a posteriori least significant difference (LSD) (Sokal and Rohlf, 1981).

Heritability Estimates.

Impatiens pallida seedlings were collected at random from one 50 X 50 m quadrat, and transferred to a garden where they were thinned and watered daily. A minimum of 36 seeds from cleistogamously derived fruits were collected from each of 34 garden-grown plants. These seed families were stored on moist paper towels in 100 X 20 mm petri dishes at 4° C until they began to germinate in late February 1988, at which time they were transferred to 3 cm peat pellets. Later, the germinated seeds were transplanted to 7.5 cm pots containing potting soil. Eighteen plants from each family were monitored for the same characters studied in the natural population, while the remainder were used to make a boundary layer at the margin of the greenhouse bench. Plants were positioned at random on the bench. The plants in each family were randomly assigned to one of two fertilizer treatments to obtain information on existence and magnitude of genotype by environment interactions. The first fertilizer treatment involved the addition on March 21 of 1.286 ±0.028 g of solid fertilizer (Jobe's 10-10-4 Plant Food Spikes). The second treatment involved the addition on April 12 of 0.638 ±0.021 g of the same solid fertilizer used in the first treatment. Approximately 95% of seeds germinated, and there was no mortality following germination. In order to preserve the numerical balance of the design, seven plants were randomly selected from each family in each fertilizer treatment. One family was discarded because it had fewer than seven plants in one of the fertilizer treatments.

The total phenotypic variance, V_{phen}, was partitioned into portions attributable to family, V_{fam}, fertilizer treatment, V_{fert}, family by fertilizer interaction, $V_{famxfert}$, and error, V_{error}. The population studied has an average coefficient of inbreeding of approximately 0.5 (S. Stewart and D. Schoen, Unpublished data). Therefore, the observed variation among families will be greater than if the coefficient of inbreeding were 0.

RESULTS

Survivorship, Fecundity, and Plant Growth.

Survivorship in the two Impatiens capensis quadrats was similar and, in general, greater than in either I. pallida quadrat. Quadrat 1 of I. pallida had the greatest mortality, especially in late May and early June, while quadrat 2 of I. capensis had the lowest (Figure 1). The distributions of the number of fruits produced per plant were positively skewed in all four quadrats (Figure 2), but quadrat 1 of I. pallida differed from the others in having three highly fecund plants. The mean number of fruits produced per plant in quadrat 1 of I. pallida was also significantly larger than that of the other quadrats. Of the morphological and life history characters, only the mean RGR in stem diameter differed between the two I. pallida quadrats. Otherwise the character means for the two quadrats were similar (Figure 3). In the case of the two I. capensis quadrats, only the mean RGR in stem diameter and the mean number of nodes on DFFB differed. On the other hand, 36 out of 44 interspecific comparisons of character means (i.e. comparisons of quadrats 1 and 2 of I. capensis with quadrats 1 and 2 of I. pallida) revealed significant differences in all of the episodes [Tukey comparison of character means, data was first rank transformed (SAS Institute Inc., 1982)] (Figure 3).

Environmental Measurements.

An examination of the soil moisture and irradiation measurements suggests that there are consistent differences among the quadrats for both soil moisture and irradiation (Table 2). An analysis of variance showed that a significant portion of the variation in gravimetric soil moisture and solar irradiation was due to differences between species and between quadrats within species, but not to measurement date (Tables 3 and 4). An a posteriori comparison of the mean soil moisture and mean irradiation confirmed quadrats differed in soil moisture and irradiation. The I. pallida quadrats were significantly drier and received less light than those of I. capensis, and the I. pallida quadrats differed in soil moisture (quadrat 1 was the driest), while the I. capensis quadrats differed in light availability (quadrat 1 received less irradiation) (Table 2).

Directional Selection Gradients.

Twenty-five out of the 96 estimates of directional selection gradients were significantly different from zero at the $P < 0.05$ level (Table 5). Four of these significant estimates were for mortality selection of juveniles (2 for I. capensis, and 2 for I. pallida), 9 were for mortality selection of pre-fruiting adults (2 for I. capensis and 7 for I. pallida), and 12 were for fecundity selection of fruiting adults (8 for I. capensis and 4 I. pallida).

In the 24 pairwise comparisons of the two I. capensis quadrats, none of the characters showed significantly different selective pressures in any episodes (Table 5). Among the 24 pairwise comparisons of the two I. pallida quadrats, only cotyledon area showed significantly different selective pressure, and then only during the pre-fruiting stage of the life cycle (Table 5).

None of the 8 interspecific comparisons of juvenile mortality selection revealed significant differences (Table 5). Out of the 44 interspecific comparisons of pre-fruiting mortality selection only two differences were significant (cotyledon area, and relative growth rate in leaf number) (Table 5). Interspecific differences in fecundity selection occured in 7 instances, and involved 4 characters (the date of establishment, the number of leaves on DFFB, the stem diameter on DFFB, and the relative growth rate in leaf number) (Table 5).

When the significance level is lowered to the 0.01 level, only 17 estimates of directional selection gradients were found to be significantly different from zero. This more conservative probability level also results in there being no differences of selection among quadrats within species. Interspecific differences also become confined to fecundity selection on date of establishment (1 instance), number of nodes on DFFB (1 instance), and relative growth rate in leaf number (2 instances).

Stabilizing Selection Gradients.

Of the total of forty-four estimates of stabilizing (or disruptive) selection, only 3 were significant different from zero (Table 6). Two were significantly less than zero (i.e stabilizing selection), and one was significantly greater than zero (i.e. disruptive selection). The significant estimates were for mortality selection on pre-fruiting plants of three different characters (number of nodes, stem diameter, and plant height on date of first flower bud production). These significant selection gradients also occurred in three different quadrats. The mean stabilizing (or disruptive) selection pressure, within each species, were also not significantly less than zero.

Heritability of Characters Studied.

Family, fertilizer, and family by fertilizer interaction effects accounted for 26.7 % to 74.8 % of the variation in the characters measured on the plants grown in the phytotron (Table 7). Overall the fertilizer treatments accounted for approximately three times more of the variation than family (35.7 and 11.7 % respectively). The family by fertilizer interaction explained an average of 3.0 % of the variation. Of the relative growth rate characters, fertilizer treatment explained greater than 63 % of the variation in 3 of the 4 cases, while family explained less than 5 % of the variation. The two characters which showed the most among-family variation were date of establishment and cotyledon area. The family by fertilizer interaction explained a significant but small part of the variation of five characters: cotyledon area, relative growth rate in plant height, number of leaves on DFFB, stem diameter on DFFB, and plant height on DFFB. The largest family by fertilizer effect was for plant height on DFFB, and it accounted for 9.4 % of the total variation.

DISCUSSION

Approximately one quarter (i.e. 25 out of 96) of the selection estimates made in the four plots of Impatiens pallida and I. capensis revealed evidence of significant directional selection, either positive or negative. There tended to be selection for earlier establishment (I. capensis-- episode 1), larger cotyledons (I. pallida-- episode 1), earlier date of initiation of the first flower bud (both species-- episode 2), larger plant height (I. pallida-- episode 2), greater numbers of leaves and larger stem diameter at the initiation of flowering (I. capensis-- episode 3), and higher relative growth rate in the numbers of leaves per plant (both species-- episode 3). Overall selection appears to favour a phenotype characterized by earlier establishment, earlier flowering, and the rapid attainment of large size, though this composite behaviour of selection was not seen in any one quadrat or species. These findings are consistent with the general findings of the selection analysis of 24 I. pallida plots conducted by Stewart and Schoen (1987).

While there is abundant evidence for directional selection of the traits studied, there was no strong evidence that directional selection is heterogeneous among plots within the same species. On the surface this finding appears to be in conflict with that reported by Stewart and Schoen (1987), but on closer examination it may corroborate their findings. In particular, Stewart and Schoen's (1987) study revealed that heterogeneous selection was related to heterogeneity in the microenvironment, as assessed through measurement of differences in soil moisture and light availability among plots. Within each of the two species studied here, there was an attempt, at the time the study plots were chosen, to minimize the among plot differences in these environmental features. Later monitoring of environmental features revealed that this attempt was successful (Tables 2, 3, 4). For instance, in contrast to the two-fold range of variation in soil moisture and irradiation among the plots studied by Stewart and Schoen (1987), there was at most 10-20% variation in the plots monitored here. Given Stewart and Schoen's (1987) finding that heterogeneity of selection estimates among plots is related to heterogeneity of soil moisture and irradiation among plots, it is perhaps not surprising that the present study failed to uncovered strong evidence of heterogeneous selection, despite the use here of much larger sample sizes within plots. This major finding strengthens the conclusion of Stewart and Schoen (1987) that heterogeneous selection in these species is associated with microsite variation in physical environmental features.

The present study provides indirect evidence that directional selection is (and has been) heterogeneous in these species. This evidence comes from the discovery of significant levels of among-family variance for most of the traits that were monitored in the selection analysis. While there are many possible explanations for the maintenance of genetic variation within populations (Hedrick et. al.,1976; Hedrick, 1986), heterogeneous directional selection is one mechanism which is often cited. Thus, the demonstration that among-family variance exists for many of the same quantitative traits which earlier studies reveal to be under heterogeneous selection (Stewart and Schoen, 1987) is consistent with the notion that genetic variation is maintained in these species by within-population differences in the direction of selection. This interpretation is contingent on the assumption that at least some of the among-family variance detected represents additive genetic variance that would be expressed under field conditions. A controlled crossing program and appropriate experimental design would be required to corroborate this assumption (Falconer, 1985).

This study revealed no consistent evidence of either significant stabilizing (or significant disruptive selection) of the characters for which there was some a priori expectation that stabilizing selection might be found (i.e. date of establishment, size at the time of first reproduction). There are a number of possible reasons for this. With regard to seedling establishment date, the a priori expectation of stabilizing selection is based on the assumption that early-germinating seeds will be at a greater risk of frost damage, whereas late-germinating individuals will be outcompeted by those which have gained an earlier foothold in the site. Yet it was logistically impossible to mark seedlings in field sites during the time of snow melt, a time when casual observation has indicated that some seedling germination occurs (Schoen, unpubl.). If individuals with very early germination and establishment dates suffer high levels of mortality and these mortality events were missed in the present study, then their non-inclusion in the selection analysis could mask stabilizing selection of establishment date. Another explanation pertains to the timing of germination in these species. Both species are characterized by strong flushes of early germination and establishment, a feature which may have evolved as a strategy for occupying space in the face of interspecific competition with perennials (Winsor, 1983). It is possible that in concert with this "territory-holding" strategy, these species have evolved physiological mechanisms to protect themselves from mortality due to late frosts, and that selection is now strictly directional, i.e. for earlier germination and establishment as suggested by the results (Table 5). With regard to size at the time of first reproduction, a trait for which there exists a theoretical expectation of an optimum (King and Roughgarden, 1982a, 1982b), the inability of this study to detect the presence of stabilizing selection may again be due to several factors. One possibility is that low levels of genetic variation underlie these traits, preventing the detection of this type of selection. Such low levels of genetic variation might be due to past selection for an optimum. To detect stabilizing selection on size at first reproduction may also require that selection estimates encompass the entire life cycle. For example, if selection for an optimum size at reproduction occurs because individuals which reproduce too early or at too small a size suffer an enhanced risk of mortality, whereas individuals which delay reproduction have higher survivorship but lower fecundity (Marks and Prince, 1981; Samson and Werk, 1986), then the detection of stabilizing selection on size at first reproduction would require that fitness measurements incorporate aspects of both juvenile and adult success (i.e. life time reproductive success). This was not feasible in the present study because the emphasis was on estimating directional selection of as large a set of characters as possible, and because mortality levels by mid-season precluded the estimation of stabilizing (or disruptive) selection gradients on this same set of characters due to insufficient sample sizes.

In conclusion, directional selection was not spatially heterogeneous, nor were date of establishment or size at first reproduction under stabilizing selection. The lack of spatially heterogeneous directional selection may be attributable to insufficient environmental heterogeneity. This corroborates the finding by Stewart and Schoen (1987) that spatially heterogeneous selection is related to microenvironmental differences. Indirectly, the discovery of significant among-family variation for all of the characters examined suggests that a mechanism for the maintenance of genetic variation is, or has been, active in these populations. In view of the importance of environmental conditions on selection pressures, studies which provide detailed descriptions of microenvironmental variation will be useful in understanding the potential for selection in these populations. It would also be interesting to know whether accurate estimation of among-family variation when plants are grown under natural conditions, would reveal significant additive genetic variation in these populations. The objectives of this thesis were to address two questions relevant to the possible role of selection in the maintenance of genetic variation. Although that role has not been completely described, the results are informative. They stress the importance of microenvironmental heterogeneity, and supported the idea that some mechanism exists which maintains genetic variation in these populations.

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Table 1. Summary of morphological and life history characters for which selection gradients were estimated.

Characters	Abbreviation
Morphological	
Cotyledon Area	CA
Relative Growth Rate in Number of Nodes	RGR(N)
Relative Growth Rate in Number of Leaves	RGR(L)
Relative Growth Rate in Stem Diameter	RGR(SD)
Relative Growth Rate in Plant Height	RGR(PH)
Life History	
Date of Establishment	DE
Date of First Flower Bud	DFFB
No. of Nodes on DFFB	N
No. of Leaves on DFFB	L
Stem Diameter on DFFB	SD
Plant Height on DFFB	PH

Table 2. Mean gravimetric soil moisture and light availability.

Species	Quadrat	Mean Soil Moisture (g water / g wet wt) X 100		Mean Light (% of full sunlight)	
I. capensis	1	83.12	a	66.23	a
I. capensis	2	81.52	a	74.72	b
I. pallida	1	40.36	b	59.22	c
I. pallida	2	54.52	c	64.90	ac

Values within a column that are followed by the same letter are not significantly different, $P < 0.05$, based on the a posteriori T-method (Sokal and Rohlf, 1981).

Table 3. Analysis of variance of gravimetric soil moisture.

Source of Variation	df	Sum of Squares	F value
Measurement Date	5	479.80	1.90 ns
Species	1	20603.96	408.94 ***
Quadrat Within Species	2	1709.47	16.96 ***
Error	59	2972.61	
Total	67	25857.41	

*** $P < 0.001$.

Table 4. Analysis of variance of solar irradiation.

Source of Variation	df	Sum of Squares	F value
Date	2	134.67	2.64 ns
Species	1	637.48	24.95 ***
Quadrat Within Species	2	469.88	9.20 ***
Error	30	766.50	
Total	35	2008.54	

*** $P < 0.001$.

Table 5. Estimated directional selection gradients (95% confidence intervals).

	Species (Quadrat)			
Character	I. capensis (1)	I. capensis (2)	I. pallida (1)	I. pallida (2)
	Episode One (Mortality Selection of Juveniles)			
Date of Establishment	-0.272 a† (±0.201)	-0.346 a (±0.260)	0.054 a (±0.164)	-0.167 a (±0.179)
Cotyledon Area	0.130 a (±0.156)	0.008 a (±0.231)	0.280 a (±0.187)	0.198 a (±0.191)
	Episode Two (Mortality Selection of Pre-Fruiting Adults)			
Date of Establishment	-0.168 a (±0.266)	0.052 a (±0.259)	0.103 a (±0.391)	0.139 a (±0.190)
Cotyledon Area	0.089 a (±0.168)	-0.029 ab (±0.207)	-0.670 b (±0.475)	0.043 a (±0.212)
Date of 1st Flower Bud (DFFB)	-0.203 a (±0.318)	-0.409 a (±0.460)	-0.293 a (±0.254)	-0.249 a (±0.160)
No. of Nodes on DFFB	0.038 a (±0.440)	0.158 a (±0.517)	0.218 a (±0.519)	-0.081 a (±0.218)
No. of Leaves on DFFB	0.105 a (±0.229)	0.192 a (±0.614)	-0.524 a (±0.845)	0.158 a (±0.178)
Stem Diam. on DFFB	-0.222 a (±0.306)	-0.176 a (±0.221)	-0.035 a (±0.741)	-0.518 a (±0.310)
Plant Height on DFFB	0.180 a (±0.306)	0.475 a (±0.286)	0.694 a (±0.555)	0.610 a (±0.267)
RGR (Nodes) ‡	0.011 a (±0.168)	-0.078 a (±0.140)	0.067 a (±0.248)	-0.136 a (±0.140)
RGR (Leaves)‡	0.146 ab (±0.176)	-0.106 b (±0.170)	0.464 ab (±0.549)	0.307 a (±0.204)
RGR (Stem Diam.)‡	-0.006 a (±0.158)	0.105 a (±0.148)	-0.199 a (±0.376)	0.038 a (±0.128)
RGR (Plant Height)‡	0.250 a (±0.188)	-0.001 a (±0.158)	0.215 a (±0.547)	0.195 a (±0.253)

Table 5 continued.

Character	Species (Quadrat)			
	I. capensis (1)	I. capensis (2)	I. pallida (1)	I. pallida (2)
	Episode Three (Fecundity Selection of Fruiting Adults)			
Date of Establishment	0.091 a † (±0.115)	-0.044 a (±0.148)	0.229 ab (±0.519)	-0.627 b (±0.416)
Cotyledon Area	0.154 a (±0.198)	0.175 a (±0.166)	0.442 a (±0.789)	-0.113 a (±0.250)
Date of 1st Flower Bud (DFFB)	-0.124 a (±0.101)	-0.043 a (±0.279)	-0.296 a (±0.373)	0.178 a (±0.330)
No. of Nodes on DFFB	-0.139 a (±0.184)	-0.086 a (±0.378)	0.555 a (±0.846)	-0.093 a (±0.414)
No. of Leaves on DFFB	0.454 a (±0.259)	0.455 a (±0.406)	0.217 ab (±2.247)	-0.507 b (±0.356)
Stem Diam. on DFFB	0.528 ab (±0.271)	0.512 b (±0.172)	-0.441 ab (±1.669)	-0.178 a (±0.482)
Plant Height	-0.011 a (±0.237)	-0.282 a (±0.202)	-0.195 a (±0.722)	-0.117 a (±0.410)
RGR (Nodes) ‡	-0.029 a (±0.083)	-0.003 a (±0.172)	-0.310 a (±0.442)	-0.118 a (±0.234)
RGR (Leaves) ‡	0.094 a (±0.093)	-0.016 a (±0.166)	0.247 ab (±0.977)	0.862 b (±0.481)
RGR (Stem Diam.) ‡	-0.028 a (±0.085)	0.019 a (±0.162)	0.167 a (±0.262)	0.170 a (±0.152)
RGR (Plant Height) ‡	0.012 a (±0.142)	0.075 a (±0.125)	0.007 a (±0.249)	0.122 a (±0.348)

† Estimates within each row that are followed by the same letter are not significantly different from one another.

‡ RGR(X) Relative growth rate measured for character X.

Table 6. Estimated stabilizing (or disruptive) selection gradients (95% confidence indervals) †.

Character	I. capensis (1)	I. capensis (2)	I. pallida (1)	I. pallida (2)
	Episode one (Mortality Selection of Juveniles)			
Date of Establishment	-0.004 (±0.097)	-0.054 (±0.102)	-0.051 (±0.106)	-0.005 (±0.079)
	Episode Two (Mortality Selection of Pre-Fruiting Adults)			
Date of Establishment	-0.038 (±0.176)	0.034 (±0.205)	0.259 (±0.521)	-0.021 (±0.273)
No. of Nodes on DFFB ‡	-0.313 (±0.241)	-0.008 (±0.195)	-0.027 (±0.665)	0.012 (±0.380)
No. of Leaves on DFFB ‡	0.223 (±0.310)	0.001 (±0.182)	-0.329 (±0.747)	-0.048 (±0.243)
Stem Diam. on DFFB ‡	-0.028 (±0.549)	-0.001 (±0.262)	-1.347 (±1.156)	-0.206 (±0.522)
Plant Height on DFFB ‡	-0.241 (±0.468)	-0.287 (±0.346)	0.241 (±1.118)	0.559 (±0.453)
	Episode Three (Fecundity Selection of Fruiting Adults)			
Date of Establishment	-0.100 (±0.107)	-0.041 (±0.123)	0.042 (±0.379)	0.012 (±0.379)
No. of Nodes on DFFB ‡	0.009 (±0.176)	-0.079 (±0.166)	-0.523 (±2.517)	-0.123 (±0.733)
No. of Leaves on DFFB ‡	-0.126 (±0.186)	-0.119 (±0.154)	1.830 (±5.011)	-0.948 (±1.151)
Stem Diam. on DFFB ‡	0.198 (±0.348)	-0.036 (±0.180)	0.175 (±1.107)	0.652 (±0.723)
Plant Height on DFFB ‡	-0.123 (±0.269)	-0.118 (±0.265)	0.600 (±1.793)	0.025 (±0.390)

† Positive coefficients indicate disruptive selection, negative coefficients indicate stabilizing selection

‡ DFFB, Date First Flower Bud was observed.

Table 7. Percentage of the total phenotypic variation due to family, fertilizer treatment, and family by fertilizer interaction. Values were estimated from analyses of variance conducted separately for each character.

Character	Family	Fertilizer	Family X Fertilizer	Error
Date of Establishment	35.2 ***	0.6	-1.3	65.5
Cotelydon Area	19.3 ***	0.2	7.2 *	73.3
Date of 1st Flower Bud (DFFB)	17.7 ***	39.1 ***	0.2	41.0
No. Nodes on DFFR	17.0 ***	17.3 ***	0.8	64.8
No. Leaves on DFFR	0.3 ***	37.7 ***	8.4 ***	53.6
Stem Diam. on DFFR	7.1 ***	58.8 ***	5.8 ***	28.5
Plant Height on DFFR	10.1 ***	12.5 ***	9.4 **	67.9
RGR (No. of Nodes) †	4.2 ***	69.6 ***	-0.1	26.3
RGR (No. of Leaves) †	11.0 ***	22.2 ***	0.2	66.6
RGR (Stem Diam.) †	3.3 ***	72.1 ***	-0.6	25.2
RGR (Plant Height) †	3.7 ***	63.2 ***	2.8 *	30.3

* P < 0.05; ** P < 0.01; *** P < 0.001.

† RGR(X) Relative growth rate measured for character X.

Figure 1. Survivorship schedules for the four study quadrats. Open and solid symbols represent Impatiens capensis and I. pallida quadrats, respectively. Squares designate quadrat 1 of each species, and circles quadrat 2. The initial sample size in each quadrat was 250 plants.

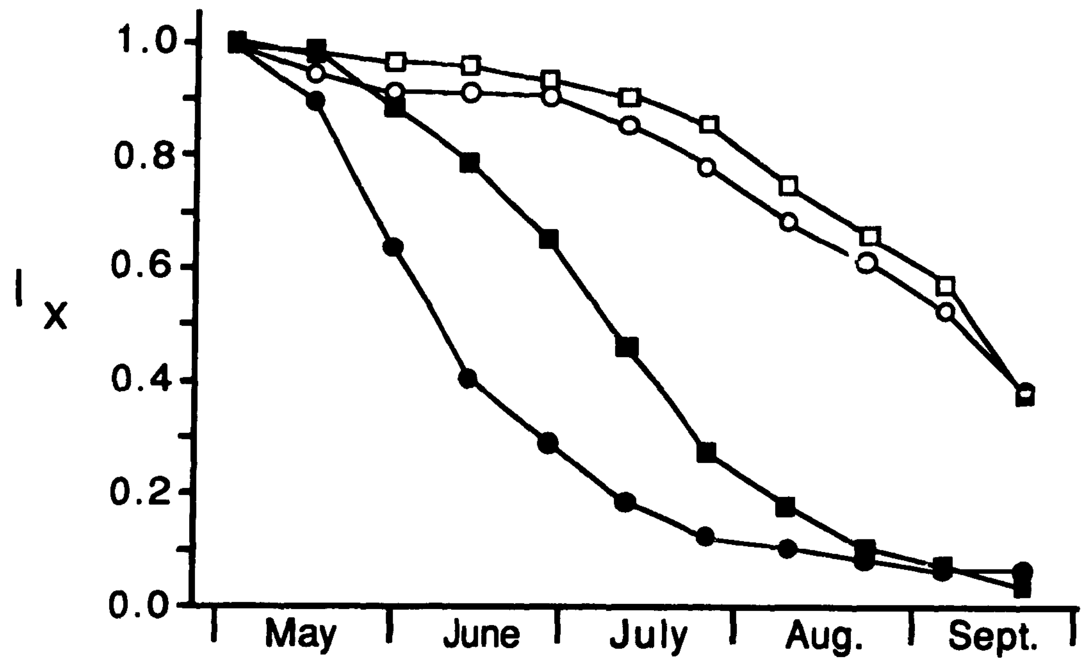

1.0
0.8
0.6
0.4
0.2
0.0
l x
May
June
July
Aug.
Sept.

Figure 2. Fecundity distributions in the four study quadrats.

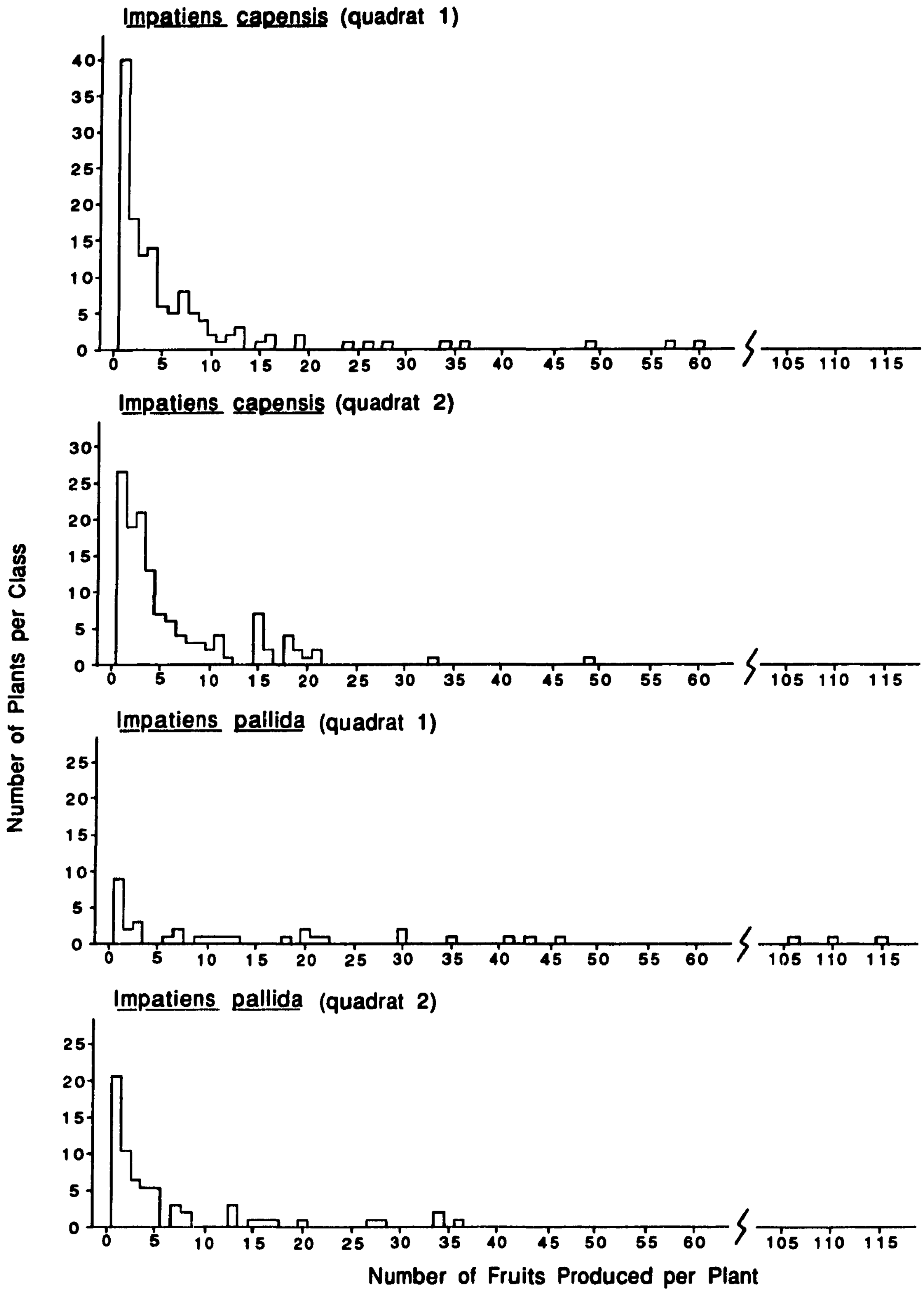
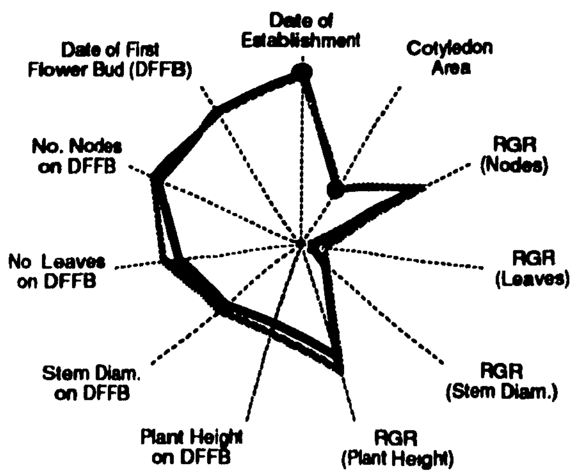
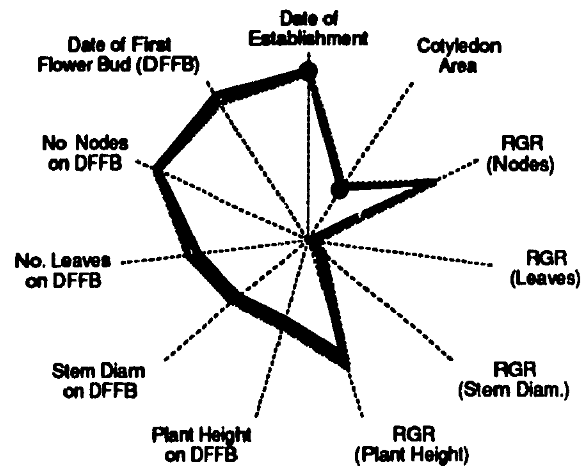

Impatiens capensis (quadrat 1)
Impatiens capensis (quadrat 2)
Impatiens pallida (quadrat 1)
Impatiens pallida (quadrat 2)
Number of Plants per Class
Number of Fruits Produced per Plant
0 5 10 15 20 25 30 35 40 45 50 55 60 105 110 115

Figure 3. Relative means of 11 characters at the beginning of the first selection episode (solid circles), the beginning of the second selection episode (solid lines), and the beginning of the third selection episode (shaded line). Scales of measurement for a given character are identical in all 4 diagrams.

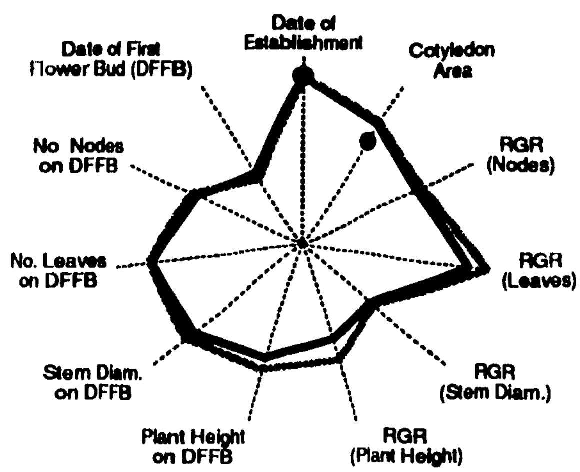
Impatiens capensis (quadrat 1)



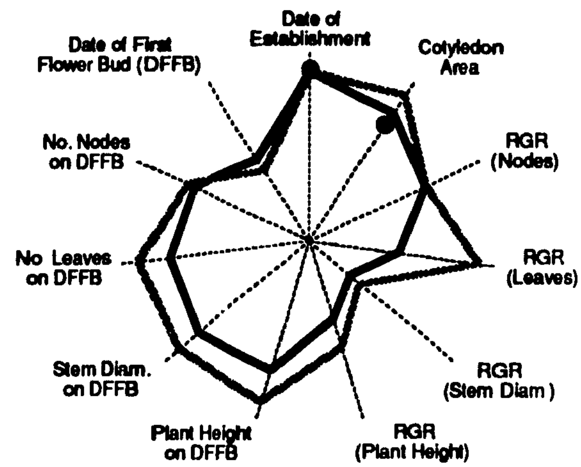
Impatiens capensis (quadrat 2)



Impatiens pallida (quadrat 1)



Impatiens pallida (quadrat 2)



APPENDIX 1. Measurement of solar irradiation. The number of film layers exposed over a 24 hour period in each of the four quadrats and in a location receiving full sun.

		Species (quadrat)				
Date	Julian Date	I. capensis (1)	I. capensis (2)	I. pallida (1)	I. pallida (2)	Full Sun
22-Jul	203	11	11	9	10	15
22-Jul	203	9	12	9	11	15
22-Jul	203	10	12	10	10	15
31-Jul	211	10	12	9	10	16
31-Jul	211	10	12	10	10	16
31-Jul	211	11	12	10	10	17
13-Aug	225	11	11	7	10	16
13-Aug	225	12	12	11	11	15
13-Aug	225	10	12	9	10	17

APPENDIX 2. Measurement of soil moisture. Expressed as the grams of water divided by the grams of fresh weight, multiplied by 100.

Date	Julian Date	Species (quadrat)			
		I. capensis (1)	I. capensis (2)	I. pallida (1)	I. pallida (2)
21-May	141	84.61	84.13	36.07	63.20
21-May	141	86.60	83.25	39.48	63.44
11-Jun	162	82.78	77.80	36.88	56.20
11-Jun	162	86.22	85.71	29.39	48.59
11-Jun	162	86.05	80.92	56.06	69.23
2-Jul	183	80.15	83.05	50.00	64.47
2-Jul	183	81.64	80.77	46.25	64.20
2-Jul	183	82.92	80.50	44.32	63.17
23-Jul	204	77.49	80.97	51.09	50.08
23-Jul	204	78.88	85.01	42.41	38.78
23-Jul	204	83.58	76.20	46.60	56.78
13-Aug	225	85.51	81.15	24.96	58.88
13-Aug	225	80.54	82.94	37.86	47.17
13-Aug	225	82.85	81.45	24.59	50.87
3-Sep	246	86.19	80.16	44.55	44.17
3-Sep	246	84.18	79.05	20.42	38.76
3-Sep	246	82.76	82.70	51.15	48.14

APPENDIX 3. The character means in each quadrat.

Character	Species (quadrat)			
	I. capensis (1)	I. capensis (2)	I. pallida (1)	I. pallida (2)
	At the beginning of Episode One (Prior to Juvenile Mortality)			
Date of Establishment	134	133	132	133
Cotyledon Area	318	302	625	702
	At the beginning of Episode Two (After Juvenile Mortality, Before Pre-Fruiting Mortality)			
Date of Establishment	133	133	131	132
Cotyledon Area	331	312	726	772
Date of First Flower Bud (DFFB)	6.3	6.8	3.3	3.8
No. Nodes on DFFB	10.1	11.1	7.7	8.4
No. Leaves on DFFB	6.6	6.0	8.1	7.7
Stem Diameter on DFFB	2.5	2.3	3.7	3.8
Plant Height on DFFB	282	282	406	462
RGR(Nodes)	0.114	0.117	0.109	0.105
RGR(Leaves)	-0.015	-0.021	0.150	0.067
RGR(Stem Diameter)	0.007	-0.009	0.070	0.033
RGR(Plant Height)	0.099	0.104	0.078	0.061
	At the beginning of Episode Three (After Pre-Fruiting Mortality, Before Producing Fruits)			
Date of Establishment	132	132	131	130
Cotyledon Area	351	333	747	874
Date of First Flower Bud (DFFB)	6.2	6.5	3.0	3.3
No. Nodes on DFFB	10.5	11.3	8.0	9.0
No. Leaves on DFFB	7.2	6.6	8.2	9.4
Stem Diameter on DFFB	2.7	2.5	3.9	4.5
Plant Height on DFFB	312	307	446	579
RGR(Nodes)	0.117	0.115	0.113	0.108
RGR(Leaves)	-0.001	-0.018	0.170	0.152
RGR(Stem Diameter)	0.012	-0.003	0.080	0.046
RGR(Plant Height)	0.115	0.115	0.101	0 092

APPENDIX 4. Raw field data collected from quadrat 1 of <u>Impatiens capensis</u>.

KEY

PL Individual plant identification number.

DE Date of establishment (the julian date the first true leaf was longer than 1.5 cm).

CA Cotyledon area on DE, calculated as the sum of the product of both cotyledon's maximum length and width (mm). Plants with only one cotyledon are indicated by an asterix (note the values indicated have not been doubled).

DD The first census date (julian date) the plant was missing or found dead.

W The week a flower bud was first observed. June 1 to 7 (julian dates 152 to 158) was week one.

N x The number of nodes (N), number of leaves (L), stem diameter in mm (SD), and plant height
L x in mm (PH), on date x. Where: x = 0 is the date a flower bud was first observed.
SD x x = 1 is week 2, June 8 to 14.
PH x x = 2 is week 5, June 30 to July 5.

A Number of cleistogamous fruits producted.

B Number of flowers produced (i.e. chasmogamous).

C Number of chasmogamous fruits produced.

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
1	140	190	210	7	8	4	1.3	132	5	5	1.5	119	6	4	1.6	130	0	0	0
2	142	325	210	7	10	5	1.9	239	6	6	1.9	180	7	5	1.9	211	0	0	0
3	146	0	231	.	.	.	.	.	4	2	1.1	91	6	3	1.2	102	0	0	0
4	136	120 *	268	.	.	.	.	.	3	3	2.2	180	2	1	2.3	168	0	0	0
5	138	120 *	224	.	.	.	.	.	6	5	1.9	159	8	4	1.6	170	0	0	0
6	140	0	210	8	10	2	1.7	128	6	5	1.7	110	8	4	1.6	120	0	0	0
7	133	276	246	7	10	6	2.1	232	6	6	2.3	208	8	5	2.1	223	2	0	0
8	140	110 *	182	.	.	.	.	.	4	4	1.3	76	.	.	.	.	0	0	0
9	134	288	268	7	11	7	2.4	253	6	4	2.2	223	8	6	2.2	233	3	0	0
10	140	265	268	9	11	4	1.9	210	6	6	2.0	189	8	4	2.1	204	0	0	0
12	134	200	246	10	11	3	1.6	194	6	6	1.8	168	8	4	1.8	171	0	0	0
13	151	0	210	.	.	.	.	.	6	4	0.9	67	7	4	1.1	79	0	0	0
14	130	338	268	6	11	8	2.7	307	8	7	2.6	235	10	8	2.6	303	3	0	0
15	144	0	268	10	10	3	1.2	126	5	5	1.5	95	8	3	1.4	119	0	0	0
16	134	253	268	5	9	7	2.0	197	6	6	2.1	182	9	7	2.0	197	3	0	0
17	132	392	268	7	12	7	2.9	406	7	7	2.7	251	10	7	2.9	331	9	0	0
18	126	450	268	10	16	10	3.4	379	8	6	3.5	250	13	5	3.5	339	1	0	0
19	133	351	268	9	13	5	2.3	342	7	6	2.5	249	9	4	2.6	324	1	0	0
20	.	.	.	.	.	.	.	.	4	2	1.4	90	5	1	1.1	98	0	0	0
21	.	.	.	.	.	.	.	.	4	4	1.3	94	5	3	1.2	98	0	0	0
22	134	300	268	6	9	4	2.0	194	6	4	2.1	170	8	4	2.0	189	0	0	0
23	130	481	268	7	12	6	2.6	384	6	6	2.8	236	10	6	2.6	329	4	0	0
24	132	352	268	6	10	5	2.5	331	6	6	2.9	239	9	5	2.7	320	4	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of <u>Impatiens capensis</u> continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
25	136	300	203	.	.	.	.	.	6	6	1.7	166	4	1	1.8	173	0	0	0
26	132	420	268	7	11	7	2.4	382	7	5	2.7	239	9	7	2.7	312	2	0	0
27	134	325	210	6	9	5	2.4	307	6	6	2.6	236	9	4	2.7	295	1	0	0
28	132	312	268	6	10	6	2.3	256	7	7	3.1	223	9	6	2.4	256	4	0	0
30	148	0	268	7	9	4	1.3	152	6	6	1.4	124	7	4	1.4	139	0	0	0
31	138	132 *	217	7	9	3	1.7	135	5	5	2.0	124	8	3	1.7	124	0	0	0
32	134	288	268	7	11	4	1.9	201	6	5	2.3	179	10	4	1.7	193	0	0	0
33	138	300	224	8	4	2	1.7	163	4	4	1.8	145	4	1	1.5	163	0	0	0
34	136	287	182	.	.	.	.	.	6	5	2.0	190	.	.	.	.	0	0	0
35	146	0	195	4	6	3	1.1	48	4	4	1.2	43	4	2	0.8	51	0	0	0
36	138	336	217	.	.	.	.	.	6	4	2.0	201	8	4	1.8	216	0	0	0
37	146	99 *	210	.	.	.	.	.	4	3	1.6	100	6	4	1.6	95	0	0	0
38	138	180	238	3	6	4	1.5	148	6	6	1.7	148	8	6	1.4	154	1	0	0
39	134	336	246	7	10	5	2.0	300	6	6	2.1	212	8	4	2.0	290	1	0	0
40	128	364	268	7	12	8	3.0	380	7	5	3.2	231	10	6	2.9	323	7	0	0
41	132	156 *	268	7	11	7	2.0	220	6	5	2.2	175	8	5	2.0	197	3	0	0
42	136	264	268	8	12	6	2.1	267	6	4	2.3	209	9	5	2.2	249	2	0	0
43	132	322	268	7	11	7	2.2	262	6	6	2.3	209	9	6	2.4	270	4	0	0
44	130	300	268	7	12	6	2.2	210	7	7	2.3	169	10	6	2.4	223	1	0	0
45	130	406	268	7	12	7	2.6	304	7	7	2.6	214	10	6	2.4	278	4	0	0
46	144	0	210	.	.	.	.	.	5	5	1.4	93	7	4	.	110	0	0	0
47	138	0	210	.	.	.	.	.	4	2	1.9	108	7	4	1.2	111	0	0	0
48	132	406	268	7	12	6	2.9	368	6	6	3.0	135	10	5	2.7	294	5	0	0
49	130	480	268	7	12	7	3.1	375	7	5	2.8	215	10	6	2.5	300	1	0	0
50	138	221	268	9	10	4	1.7	149	6	6	1.8	136	7	3	1.6	156	0	0	0
51	151	0	231	12	10	1	1.2	99	5	3	1.5	92	7	3	1.4	92	0	0	0
52	142	252	224	7	9	3	1.9	182	6	5	1.6	159	8	5	1.6	180	0	0	0
53	136	266	231	9	10	4	2.0	208	6	6	1.9	169	7	5	2.0	193	0	0	0
54	136	242	231	7	11	5	2.3	260	6	5	2.2	194	9	5	2.0	240	0	0	0
55	132	338	268	7	11	5	2.7	316	6	5	2.4	193	9	5	2.4	268	0	0	0
56	134	276	238	7	10	4	2.2	258	6	6	2.1	200	8	4	2.0	242	1	0	0
57	136	312	268	7	11	5	2.2	244	6	5	2.2	189	9	5	2.0	235	2	0	0
58	132	288	217	.	.	.	.	.	6	4	1.9	163	9	3	1.6	182	0	0	0
59	138	220	210	4	8	3	1.9	193	6	5	1.9	176	8	4	1.7	200	0	0	0
60	138	220	231	9	11	4	2.2	200	6	6	2.1	170	8	4	1.9	193	0	0	0
62	133	276	268	7	11	6	2.2	245	6	5	2.2	196	8	4	1.9	228	0	0	0
63	138	231	268	7	10	4	1.9	163	6	6	1.8	138	9	5	1.5	160	0	0	0
64	134	310	231	7	11	5	2.5	250	6	6	2.3	181	9	4	2.0	240	2	0	0
65	142	110 *	195	6	5	2	1.4	102	4	2	1.2	109	5	2	1.4	102	0	0	0
66	132	450	268	8	12	5	2.6	331	6	5	2.7	203	9	3	2.6	283	1	0	0
67	136	378	246	9	10	4	2.1	241	6	5	2.2	196	8	6	1.9	231	0	0	0
68	132	421	268	6	9	5	2.4	328	6	5	2.4	209	9	5	2.2	290	2	0	0
69	138	200	238	.	9	0	1.7	150	6	5	1.7	130	7	3	1.6	141	0	0	0
70	.	.	.		.	.	.	.	4	4	1.3	88	6	4	1.0	96	0	0	0
71	134	338	217	.	.	.	.	.	6	4	2.3	208	9	4	2.1	284	0	0	0
72	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
74	142	110 *	182	.	.	.	.	.	6	5	1.8	153	.	.	.	.	0	0	0
75	140	72 *	182	.	.	.	.	.	6	4	1.6	121	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of <u>Impatiens</u> <u>capensis</u> continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
76	133	313	231	8	11	5	2.0	285	6	5	2.2	197	9	5	2.2	270	0	0	0
77	138	130 *	217	.	.	.	.	.	6	4	1.6	118	8	3	1.4	137	0	0	0
78	144	0	210	.	.	.	.	.	6	4	2.1	162	8	3	1.6	181	0	0	0
79	142	160	217	.	.	.	.	.	4	4	1.4	101	6	2	1.3	105	0	0	0
80	134	288	246	10	14	7	2.0	236	6	4	2.1	190	8	3	2.0	220	0	0	0
81	133	242	224	10	11	2	1.5	200	6	5	1.7	181	9	3	1.7	198	0	0	0
82	144	110 *	231	7	8	3	1.5	149	4	4	1.7	129	7	5	1.6	142	0	0	0
83	133	325	268	7	11	7	2.6	366	6	6	2.0	205	8	4	2.6	277	3	0	0
84	132	420	268	7	11	6	2.5	255	6	5	2.3	199	8	4	2.4	276	4	0	0
85	151	0	196	4	7	4	1.8	160	6	6	1.9	146	8	4	1.9	169	0	0	0
86	138	0	196	.	.	.	.	.	6	3	1.6	114	8	3	1.6	120	0	0	0
87	.	.	.	.	.	.	.	.	2	1	0.9	40	.	.	.	.	0	0	0
88	136	392	268	8	11	6	2.1	369	6	6	2.3	198	8	5	2.0	299	2	0	0
89	140	273	231	10	10	4	1.5	178	5	5	1.6	145	7	4	1.6	167	0	0	0
90	136	338	231	7	10	5	2.3	313	6	6	2.2	196	8	4	1.8	290	0	0	0
91	133	450	268	8	11	7	2.2	401	6	6	2.4	198	8	4	2.5	297	3	0	0
92	133	421	268	7	11	6	2.6	379	6	5	2.3	200	9	7	2.3	286	7	0	0
93	134	364	238	8	11	6	2.4	346	6	6	2.3	220	8	4	2.4	303	1	0	0
94	132	337	268	6	10	6	2.0	224	6	6	2.1	186	9	5	2.0	217	2	0	0
95	130	450	268	7	12	7	2.8	390	7	7	2.9	220	9	5	2.9	319	8	0	0
96	132	435	268	7	11	7	2.8	388	7	6	2.4	221	9	6	2.4	308	4	0	0
97	140	200	246	9	9	3	1.6	142	5	4	1.4	113	6	4	1.5	126	1	0	0
100	140	250	231	6	10	3	1.9	150	6	5	2.1	140	9	3	2.0	155	0	0	0
101	140	336	238	8	12	6	2.1	258	6	5	2.1	200	8	6	1.9	234	1	0	0
103	133	336	268	9	15	7	2.6	459	7	6	2.6	204	10	7	2.6	311	4	0	0
104	144	0	246	12	10	0	1.2	130	4	4	1.4	110	7	3	1.2	125	0	0	0
105	140	0	268	4	8	4	1.9	147	6	6	2.0	129	8	3	1.8	145	0	0	0
106	134	210	268	6	9	5	1.9	190	6	5	2.1	171	8	4	1.8	191	1	0	0
107	146	0	231	.	.	.	.	.	4	4	1.1	78	8	2	1.1	94	0	0	0
108	140	252	238	5	6	4	1.0	87	4	4	1.1	82	6	4	1.0	87	0	0	0
110	130	429	268	7	13	9	2.8	417	7	7	2.8	202	10	6	2.4	317	9	0	0
111	132	406	218	6	11	7	3.0	318	7	7	2.8	223	10	7	2.9	300	1	0	0
112	132	392	268	6	12	8	3.2	306	8	8	3.2	219	11	7	3.0	295	13	0	0
113	125	648	268	7	14	13	4.5	429	8	8	4.2	239	11	8	4.3	339	16	3	0
114	136	110 *	268	6	10	6	2.3	150	6	6	1.9	120	9	7	1.7	144	2	0	0
115	134	143	246	6	10	6	2.6	238	7	5	2.4	141	10	6	2.6	226	4	0	0
116	142	288	268	10	14	12	2.9	245	6	6	2.3	124	9	7	2.5	208	2	0	0
117	127	377	268	6	14	26	6.9	499	9	9	4.7	230	13	19	5 7	434	32	37	25
118	132	392	268	7	14	7	3.9	391	7	6	3.4	199	12	7	3.5	340	7	0	0
119	136	334	268	3	7	7	2.0	144	6	6	2.0	147	8	6	2.2	158	5	0	0
120	142	0	238	12	9	1	1.2	110	6	3	1.6	94	8	3	1.2	109	0	0	0
121	134	406	268	6	10	6	2.3	331	6	6	2.5	202	9	6	2.4	300	6	0	0
122	144	0	210	.	.	.	.	.	4	4	1.1	74	6	4	1.1	96	0	0	0
123	130	392	268	7	11	7	3.1	271	7	6	2.8	201	9	6	2.8	253	1	0	0
124	140	220	268	7	9	5	1.8	126	5	5	1.7	99	8	6	1.6	127	0	0	0
125	132	420	268	7	12	8	3.2	403	7	7	3.0	216	9	7	3.0	310	6	0	0
126	132	277	268	7	11	6	2.3	245	7	5	2.2	190	9	5	2.0	236	0	0	0
127	140	156 *	203	.	.	.	.	.	4	4	1.2	100	6	2	1.3	97	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of <u>Impatiens</u> <u>capensis</u> continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
128	146	171	203	.	.	.	.	.	4	3	1.2	95	4	2	1.4	106	0	0	0
129	132	252	268	10	6	9	3.0	308	6	6	2.9	213	6	5	3.2	301	0	0	0
130	130	352	268	7	12	7	2.9	363	7	7	2.6	214	10	6	2.9	297	7	0	0
131	138	276	196	.	.	.	.	.	6	6	1.8	130	7	5	1.8	151	0	0	0
133	127	512	268	4	9	7	3.1	310	8	8	3.0	226	10	8	3.2	338	19	0	0
134	136	190	268	5	8	6	1.9	141	6	6	1.9	121	8	6	1.9	141	2	0	0
135	140	72 *	239	6	6	4	1.5	199	6	5	1.8	169	7	5	1.6	197	1	0	0
136	132	240	268	6	4	6	2.5	206	4	3	2.4	189	4	4	2.3	200	1	0	0
137	132	288	268	12	4	4	2.3	190	6	5	2.1	158	6	7	2.3	200	1	0	0
142	130	420	268	7	13	7	3.3	310	6	6	3.4	207	12	5	3.3	290	3	0	0
143	125	496	268	7	16	23	6.3	495	9	9	4.6	246	13	11	5.6	398	27	10	7
144	128	422	268	5	12	9	4.4	390	8	8	3.8	223	12	9	4.4	390	22	6	2
145	126	406	268	4	11	8	4.2	300	9	9	3.6	220	12	8	3.9	316	12	0	0
146	125	665	268	5	13	11	5.1	454	9	9	4.3	259	13	11	5.1	454	29	27	20
147	130	312	268	5	11	8	2.7	290	8	7	2.7	214	11	8	2.7	290	7	0	0
148	130	339	268	6	13	9	3.6	408	8	7	3.1	245	12	8	3.5	263	9	0	0
149	132	464	268	6	11	7	3.5	431	7	7	2.9	237	10	8	3.4	394	12	0	0
150	132	375	268	5	10	7	3.4	311	7	7	3.0	210	10	7	3.4	311	4	0	0
151	136	326	268	6	10	6	2.9	219	6	6	2.4	167	9	7	2.6	209	2	0	0
152	136	405	268	3	8	8	3.0	287	7	7	2.7	236	11	8	3.5	301	8	0	0
153	128	576	268	6	14	20	5.4	506	8	8	4.2	258	12	14	5.5	460	58	5	2
154	146	240	268	3	5	5	1.2	85	4	4	1.1	79	6	6	1.1	91	2	0	0
155	138	200	268	6	10	7	1.9	159	6	6	1.7	113	9	7	2 0	150	3	0	0
156	130	465	268	6	13	11	4.2	474	8	7	3.7	242	12	10	4.0	432	26	1	0
157	132	375	268	6	9	7	1.8	163	6	6	1.6	139	8	6	1.9	162	6	0	0
158	146	189	268	8	9	5	1.9	140	5	5	1.6	89	8	6	1.7	123	1	0	0
159	132	480	268	9	15	13	3.9	591	8	7	3.2	208	11	8	3.7	376	15	0	0
160	132	338	268	4	10	8	2.9	312	8	8	2.8	205	12	9	3.1	357	5	0	0
161	138	384	268	3	6	6	1.1	110	5	5	1.4	108	7	5	1.4	117	1	0	0
162	138	265	225	3	6	6	1.6	95	5	5	1.0	90	6	4	1.3	98	1	0	0
163	.	.	.	4	4	4	0.8	27	4	4	0.8	30	4	2	0.8	30	0	0	0
164	132	286	268	5	10	6	2.9	368	7	7	2.4	197	10	6	2.9	368	5	0	0
165	125	450	268	6	12	8	3.9	423	8	8	3.1	195	11	8	4 0	380	5	0	0
166	132	312	268	6	11	5	3.0	370	7	6	2.2	195	11	7	2 8	350	4	0	0
167	136	253	268	7	10	5	2.2	209	6	6	2.5	142	9	7	2.1	195	2	0	0
168	146	72 *	268	3	4	4	1.0	47	4	4	1.0	50	5	3	1.0	50	0	0	0
169	148	0	196	.	.	.	.	.	4	4	1.1	41	5	3	1.0	50	0	0	0
171	128	435	268	7	14	9	4.2	487	8	8	3.3	175	11	7	4.2	368	16	0	0
173	148	0	247	5	6	5	0.9	60	4	4	0.8	48	6	5	0.9	60	0	0	0
174	133	273	189	2	6	4	1.3	90	6	4	1.3	90	7	2	1.5	95	0	0	0
175	151	0	204	.	.	.	.	.	4	4	1.4	79	7	5	1.1	100	0	0	0
176	130	434	268	7	15	20	6.0	510	9	9	4 2	222	12	8	5.6	396	34	9	2
177	132	324	189	2	6	6	1.6	112	6	6	1.6	112	7	2	1.5	111	1	0	0
178	132	242	268	7	13	9	4.1	430	8	8	3.1	166	11	8	3.6	346	9	0	0
179	136	260	268	3	6	4	1.3	80	5	5	1.2	79	7	5	1.1	90	4	0	0
180	130	364	268	6	12	7	4.1	359	8	8	3.5	144	11	8	3.8	333	6	0	0
181	140	0	211	3	5	3	1.1	54	4	4	1.3	49	6	4	1.2	59	1	0	0
182	132	392	268	8	14	8	3.5	535	8	7	2.9	169	10	6	3.3	360	6	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of <u>Impatiens</u> <u>capensis</u> continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
183	136	263	268	4	6	5	1.4	99	4	4	1.2	82	6	4	1.2	94	1	0	0
184	132	392	268	8	12	7	2.4	350	6	5	2.5	190	10	5	2.5	333	2	0	0
185	132	300	204	3	7	6	2.3	208	6	6	2.5	170	9	6	2.1	243	1	0	0
186	144	81 *	204	3	5	4	1.0	51	4	3	1.3	49	6	4	1.4	53	0	0	0
188	.	.	.	.	.	.	.	.	4	4	0.8	32	5	3	1.1	35	0	0	0
189	133	220	268	4	8	6	2.2	221	6	6	2.0	180	9	5	1.9	227	2	0	0
190	132	311	268	5	7	5	1.5	106	5	4	1.4	86	7	5	1.5	106	0	0	0
191	128	741	268	6	12	7	3.4	352	8	7	2.9	211	11	7	2.9	338	7	0	0
192	138	190	268	3	6	4	1.2	80	4	4	1.1	79	6	4	1.1	93	1	0	0
194	144	0	183	.	.	.	.	.	4	4	0.7	43	.	.	.	.	0	0	0
195	138	297	268	3	5	5	1.1	110	4	4	1.4	109	6	4	1.3	120	1	0	0
196	142	120 *	211	.	.	.	.	.	4	4	1.1	61	4	2	1.3	72	0	0	0
197	136	252	196	.	.	.	.	.	6	6	2.0	182	8	5	2.0	239	0	0	0
198	136	275	196	.	.	.	.	.	4	4	1.3	103	6	4	1.4	101	0	0	0
199	133	473	268	3	6	5	1.7	120	6	6	1.5	102	7	5	1.8	133	1	0	0
200	136	90 *	189	.	.	.	.	.	4	2	1.1	57	4	1	0.9	60	0	0	0
201	127	434	204	3	6	4	1.7	118	6	6	1.8	111	7	5	2.0	122	0	0	0
202	132	392	268	5	11	7	2.9	413	8	7	2.9	258	11	7	2.9	413	8	0	0
203	128	421	268	6	11	5	3.1	313	6	6	3.0	219	10	5	2.8	311	1	0	0
204	126	450	268	8	16	21	4.4	655	8	8	3.2	284	12	10	4.1	473	28	0	0
205	125	325	268	5	11	8	2.7	392	8	7	2.6	290	11	8	2.7	392	3	0	0
206	132	351	268	7	11	6	2.7	417	6	6	2.5	260	9	7	2.7	388	4	0	0
207	128	465	268	8	15	16	4.3	616	8	8	3.2	286	11	8	4.0	450	10	0	0
208	140	163	183	3	4	2	0.9	77	4	3	0.9	76	.	.	.	.	0	0	0
209	132	390	268	3	5	3	1.2	106	4	3	1.3	110	6	4	1.2	121	0	0	0
210	140	80 *	183	.	.	.	.	.	4	4	.	80	.	.	.	.	0	0	0
211	140	182 *	168	.	.	.	.	.	3	1	1.5	77	.	.	.	.	0	0	0
212	130	340	268	5	10	7	2.6	461	7	7	2.4	270	10	7	2.6	461	8	0	0
213	134	231	268	7	11	7	1.9	250	6	6	2.6	184	9	6	2.3	232	0	0	0
214	134	334	268	6	7	5	1.3	199	4	4	1.7	100	6	4	1.5	113	2	0	0
215	132	312	268	6	10	7	2.3	271	6	6	2.0	226	10	6	2.0	278	2	0	0
216	136	242	204	5	8	5	2.0	232	6	5	1.9	174	8	5	2.0	232	1	0	0
217	132	365	268	6	11	9	3.0	460	7	7	2.3	249	10	6	2.7	444	8	0	0
218	132	300	189	.	.	.	.	.	6	6	2.3	248	9	7	2.2	305	0	0	0
219	132	252	268	5	9	7	2.4	244	6	6	2.4	158	9	7	2.4	244	3	0	0
220	130	312	268	5	12	9	3.6	373	6	6	3.1	179	12	9	3.6	373	10	0	0
223	142	221	268	3	5	5	1.2	97	4	4	1.4	99	6	4	1.4	111	0	0	0
224	.	.	.	.	.	.	.	.	2	0	.	38	.	.	.	.	0	0	0
225	146	288	268	9	10	4	1.8	152	4	4	1.5	90	8	5	1.7	138	1	0	0
226	130	406	268	6	11	6	3.2	404	7	7	2.7	180	10	7	3.2	360	7	0	0
227	134	300	248	7	11	5	2.1	260	7	5	2.1	210	9	4	2.1	256	1	0	0
228	132	325	268	6	10	6	2.4	349	6	6	2.4	204	9	7	2.6	340	1	0	0
229	132	420	268	5	10	6	3.6	410	7	7	2.9	233	10	6	3.6	410	5	0	0
230	132	312	268	8	11	4	2.3	281	6	6	2.6	217	8	6	2.3	268	1	0	0
231	127	416	268	6	12	7	3.8	459	8	8	3.8	236	11	7	3.5	400	19	0	0
232	132	276	248	6	9	5	2.4	271	6	5	2.4	217	9	6	2.4	267	3	0	0
233	133	210	268	7	10	5	1.7	200	6	6	1.9	148	8	6	1.9	184	1	0	0
235	132	264	218	4	9	7	2.3	309	7	5	2.3	234	10	7	2.6	331	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of *Impatiens capensis* continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
236	132	190	268	6	11	7	2.3	343	8	8	2.1	233	10	6	2.4	340	1	0	0
237	148	0	189	.	.	.	.	.	4	4	0.8	41	4	2	0.8	42	1	0	0
238	132	391	268	6	10	8	2.3	360	7	6	2.3	240	10	8	2.6	359	7	0	0
239	132	312	268	6	10	6	2.3	385	6	6	2.1	239	9	6	2.6	374	4	0	0
240	134	253	268	8	10	5	1.5	212	6	6	2.0	175	8	4	2.0	198	0	0	0
241	130	435	268	6	12	7	3.7	471	7	7	3.2	258	11	8	3.7	426	11	0	0
242	136	219	239	3	5	5	1.1	89	4	4	1.3	81	6	4	1.4	100	1	0	0
243	133	143 *	268	3	6	6	1.4	101	4	4	1.4	91	7	5	1.9	108	1	0	0
244	125	480	268	7	14	8	3.5	537	8	7	2.8	268	11	6	3.3	429	13	0	0
245	130	337	268	7	12	6	3.0	460	7	7	2.9	250	10	6	2.9	400	3	0	0
246	132	326	268	5	11	7	3.1	398	8	8	2.7	222	11	7	3.1	398	13	0	0
248	134	286	268	3	6	6	1.5	98	5	5	1.6	95	7	5	1.3	112	1	0	0
249	136	0	239	7	9	5	1.7	150	6	6	1.7	112	8	4	2.0	139	1	0	0
250	132	121 *	268	6	11	7	2.8	420	8	6	2.4	241	11	8	2.7	389	3	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens capensis (see page 41 for key).

PL	DE	CA	DD	W	NO	LO	SDO	PHO	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
1	127	351	268	2	9	9	3.2	265	9	9	3.2	265	13	16	4.7	430	29	6	4
2	133	325	201	3	6	6	1.4	141	6	6	1.5	126	8	6	1.7	150	1	0	0
3	138	263	268	6	10	7	2.2	211	6	6	2.3	168	9	7	2.3	201	3	0	0
4	127	274	268	6	13	9	3.7	378	9	8	3.2	220	12	9	3.6	347	13	6	2
5	132	351	261	6	11	6	2.6	309	7	6	2.6	201	10	7	2.5	299	5	0	0
6	127	416	251	5	8	6	2.0	206	7	7	1.9	171	8	6	2.0	206	3	0	0
7	133	210	268	7	12	7	2.4	380	6	6	2.3	190	9	7	2.5	330	4	0	0
8	140	0	223	7	10	4	1.6	148	6	6	2.0	93	7	5	1.6	139	0	0	0
9	144	0	261	9	10	4	1.2	147	6	6	1.5	109	7	5	1.4	130	0	0	0
10	142	288	208	5	8	6	1.5	134	6	5	1.6	114	8	6	1.5	134	0	0	0
11	132	312	261	8	12	6	2.4	351	7	7	2.0	225	10	5	2.0	310	3	0	0
12	132	300	236	6	10	6	2.1	348	7	6	2.4	231	10	7	2.1	323	0	0	0
13	140	0	180	.	.	.	.	.	6	5	1.4	77	.	.	.	.	0	0	0
14	133	288	251	6	10	5	2.0	339	6	6	2.0	211	9	7	2.1	316	1	0	0
15	136	242	243	8	11	5	2.0	220	6	6	1.9	168	8	5	1.7	202	2	0	0
16	133	312	268	5	10	7	2.6	311	7	7	2.3	195	10	7	2.6	311	4	0	0
17	127	434	268	5	11	9	3.4	319	8	7	2.9	202	11	9	3.4	319	8	0	0
18	144	0	208	.	.	.	.	.	5	5	1.4	100	7	5	1.4	111	0	0	0
19	142	0	261	6	10	5	1.7	170	6	4	1.8	131	9	5	1.8	161	1	0	0
20	130	265	261	5	10	6	2.7	348	4	4	2.1	226	10	6	2.7	348	1	0	0
21	144	220	251	12	12	2	1.5	198	5	5	1.4	159	7	4	1.8	178	0	0	0
22	133	326	261	5	6	4	1.6	119	4	4	1.8	100	6	4	1.6	119	0	0	0
23	134	338	261	5	10	6	2.6	352	7	7	2.8	220	10	6	2.6	352	5	0	0
24	144	132 •	223	5	5	3	1.4	99	4	4	1.4	88	5	3	1.4	99	0	0	0
25	151	0	173	.	.	.	.	.	4	2	1.4	86	.	.	.	.	0	0	0
26	133	351	236	8	11	5	2.5	340	6	6	2.4	202	9	7	2.2	311	1	0	0
27	130	512	268	6	11	7	2.8	359	7	7	2.7	195	10	7	2.8	319	5	0	0
28	130	435	268	6	11	6	2.5	368	7	6	2.9	214	10	7	2.5	331	0	0	0
29	132	464	261	3	6	6	1.7	170	6	6	1.8	156	8	6	1.6	191	3	0	0
30	133	464	133	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
31	127	310	268	3	8	6	2.2	217	7	7	2.2	184	10	8	2.1	262	11	0	0
32	126	540	268	7	15	23	4.9	534	9	9	4.0	236	13	12	4.7	440	39	22	10
33	125	486	268	4	8	6	2.3	256	7	7	2.4	219	9	7	2.1	260	7	1	0
34	138	190	268	4	8	6	1.5	149	6	6	1.6	130	9	6	1.5	151	3	0	0
35	130	0	132	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
36	130	527	268	7	14	10	4.3	480	8	8	3.5	245	12	9	4.1	400	21	4	0
37	136	180	261	7	10	6	2.0	198	6	5	1.8	153	9	6	1.7	186	2	0	0
38	130	322	268	6	11	7	3.2	382	8	8	2.8	216	11	8	2.9	372	10	0	0
39	136	244	229	9	11	7	1.9	204	6	5	2.0	167	8	6	2.1	184	1	0	0
40	134	221	208	6	8	6	1.3	100	5	3	1.4	109	8	6	1.3	105	0	0	0
41	130	406	268	8	14	8	3.0	417	8	6	2.6	223	11	7	2.9	334	5	0	0
42	142	312	261	6	11	6	1.9	160	8	5	2.1	141	10	6	1.9	150	1	0	0
43	128	421	268	5	11	8	3.9	365	8	8	3.0	202	11	8	3.9	365	14	3	2
44	144	0	268	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
45	151	0	268	5	8	5	1.6	118	6	5	1.6	107	8	5	1.6	118	3	1	0
46	138	154	226	6	9	5	1.8	133	6	5	1.7	123	8	4	1.7	141	1	0	0
47	130	350	268	11	17	12	2.8	441	8	7	2.8	230	10	7	2.7	340	3	0	0
48	136	231	261	7	10	4	1.9	260	7	7	2.0	204	9	5	2.0	250	1	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of <u>Impatiens</u> <u>capensis</u> continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
49	133	231	208	6	10	5	1.9	230	6	6	2.0	200	9	5	2.0	231	0	0	0
50	132	406	268	6	11	7	2.4	370	7	7	2.6	222	10	6	2.4	344	3	0	0
51	127	419	268	6	11	6	2.7	398	8	8	2.6	242	11	6	2.6	363	15	0	0
52	136	72 *	261	6	9	5	1.8	181	6	6	1.8	154	9	5	1.7	180	0	0	0
53	133	364	243	6	10	6	2.2	335	6	6	2.4	210	9	6	2.3	297	4	0	0
54	128	612	268	7	12	6	3.1	421	8	8	3.0	239	11	7	3.0	360	6	0	0
55	136	241	236	7	10	5	1.8	229	6	6	1.9	188	8	4	1.9	212	0	0	0
56	130	403	268	7	12	7	2.3	360	7	6	2.3	189	10	6	2.3	298	3	0	0
57	130	364	268	7	12	5	2.6	371	7	7	2.1	185	10	5	2.2	300	5	0	0
58	136	276	268	7	11	6	2.3	345	6	5	2.1	190	9	6	1.8	308	2	0	0
59	132	351	223	6	9	4	2.2	319	6	6	2.0	200	9	4	2.3	292	1	0	0
60	140	108 *	194	6	6	2	1.0	85	4	4	1.3	76	6	4	1.0	88	0	0	0
61	142	200	194	.	.	.	.	.	6	5	1.4	130	7	3	1.2	151	0	0	0
62	130	465	268	9	14	9	2.4	443	7	7	2.7	216	10	6	2.4	331	8	0	0
63	133	312	251	6	10	6	2.1	350	6	6	2.0	213	9	5	2.0	334	1	0	0
64	.	.	.	.	.	.	.	.	4	4	1.5	85	5	1	0.9	86	.	.	.
65	142	200	236	.	.	.	.	.	5	5	1.5	120	8	3	1.7	93	0	0	0
66	130	392	268	7	12	6	2.5	350	7	5	2.3	186	10	5	2.4	275	3	0	0
67	134	0	187	5	8	3	1.5	153	.	.	.	.	8	3	1.5	153	0	0	0
68	132	288	268	8	12	5	1.9	298	.	.	.		10	4	2.0	269	0	0	0
69	.	.	.	.	.	.	.	.	4	2	.	89	.	.	.	.	.	.	.
70	138	0	208	7	9	5	1.8	159	6	6	1.8	134	8	5	1.8	141	0	0	0
71	130	450	261	8	12	6	2.2	389	7	6	2.8	211	10	6	2.3	318	4	0	0
72	132	263	261	6	10	6	2.3	333	6	6	2.2	196	9	5	2.4	306	3	0	0
73	142	110 *	243	7	11	5	2.0	225	6	4	2.3	179	9	5	1.8	215	1	0	0
74	142	80 *	208	.	.	.	.	.	5	5	1.3	93	7	3	1.2	114	0	0	0
75	136	0	201	.	.	.	.	.	6	6	1.8	140	8	4	1.7	162	0	0	0
76	138	140	194	3	5	3	1.1	106	4	4	1.2	90	6	4	1.2	96	0	0	0
77	132	338	268	8	13	9	2.0	360	7	5	2.2	203	10	6	1.9	285	3	0	0
78	133	364	236	10	13	3	2.2	269	6	6	2.3	172	9	4	2.3	243	0	0	0
79	136	325	251	7	10	4	2.0	271	6	5	1.9	190	9	5	1.6	250	1	0	0
80	144	110 *	243	12	11	2	1.5	161	5	5	1.5	129	6	3	1.3	144	0	0	0
81	142	110 *	229	.	.	.	.	.	6	6	1.4	96	8	3	1.2	123	0	0	0
82	136	264	216	.	.	.	.	.	6	6	2.4	173	8	4	1.6	249	0	0	0
83	130	392	268	10	15	7	2.6	370	6	6	2.5	206	10	5	2.4	317	3	0	0
85	144	100 *	202	.	.	.	.	.	4	4	1.3	109	7	3	1.2	129	0	0	0
86	132	392	261	9	13	5	2.5	383	6	6	2.3	194	9	4	2.3	282	2	0	0
87	140	0	187	.	.	.	.	.	4	2	1.2	71	5	2	1.1	240	0	0	0
88	134	325	261	11	13	5	1.9	241	6	6	1.9	162	8	4	1.7	210	1	0	0
89	136	232	268	6	10	6	2.3	250	6	6	2.4	151	9	5	2.5	240	3	0	0
90	144	0	208	.	.	.	.	.	5	3	1.4	100	8	4	1.2	120	0	0	0
91	142	179	223	10	10	3	1.3	140	5	5	1.6	106	8	5	1.2	129	0	0	0
92	142	110 *	261	11	12	4	1.6	176	6	5	1.8	140	8	4	1.6	157	1	0	0
93	146	56 *	251	12	9	1	1.3	127	4	4	1.2	103	6	3	1.0	105	0	0	0
94	132	406	268	6	12	7	2.8	310	8	7	2.6	193	11	7	2.7	279	15	0	0
95	130	288	268	5	10	6	2.3	240	8	7	2.4	186	10	6	2.3	240	3	0	0
96	138	0	223	5	6	4	1.3	96	4	4	1.4	79	6	4	1.3	96	0	0	0
97	128	480	268	6	11	7	3.0	323	8	6	2.9	199	11	7	2.8	300	18	1	1

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens capensis continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
98	130	392	268	5	10	6	1.5	271	7	6	2.5	183	10	6	2.5	271	6	0	0
99	132	254	216	7	11	5	2.0	192	7	5	2.0	159	9	5	1.8	180	0	0	0
100	127	450	268	7	13	8	3.4	370	8	8	3.0	199	11	7	3.0	295	13	3	2
101	132	130 *	268	7	12	6	2.5	269	7	6	2.4	165	10	6	2.2	250	4	0	0
102	133	120 *	223	7	10	4	1.9	162	7	5	2.2	130	10	5	1.9	153	0	0	0
104	128	378	268	5	11	7	3.0	278	8	8	2.9	185	11	7	3.0	278	16	0	0
105	130	421	268	5	11	8	2.9	289	7	7	2.8	199	11	8	2.9	289	17	2	1
106	133	276	268	7	12	6	2.0	333	6	5	2.0	183	10	6	1.8	260	3	0	0
107	130	365	268	7	12	8	2.3	322	7	6	2.1	187	10	7	2.4	246	5	0	0
108	136	264	268	6	9	5	1.6	258	6	5	1.7	179	8	6	1.8	245	1	0	0
109	136	100 *	268	8	10	5	1.5	179	6	6	1.7	139	9	4	1.6	174	0	0	0
110	132	313	223	.	.	.	.	.	7	5	2.3	190	10	6	2.0	221	0	0	0
111	133	363	261	8	12	5	2.2	310	6	6	2.4	199	9	6	2.3	288	1	0	0
112	132	338	216	.	.	.	.	.	6	4	1.8	110	8	4	1.6	136	0	0	0
113	151	0	216	.	.	.	.	.	4	4	1.0	77	7	3	1.0	141	0	0	0
114	132	313	261	7	11	5	2.1	285	7	7	2.0	196	10	6	2.0	260	0	0	0
115	128	464	268	7	13	9	3.0	411	8	8	2.7	239	10	6	2.6	332	15	0	0
116	138	156 *	223	.	.	.	.	.	6	6	1.8	123	8	4	1.5	140	0	0	0
117	134	311	261	10	13	5	1.8	314	6	6	2.0	201	9	6	2.1	276	2	0	0
118	130	418	268	6	11	7	2.4	360	7	7	2.6	216	10	6	2.5	316	7	0	0
119	132	420	229	11	14	3	2.2	340	7	6	2.3	203	10	5	2.2	303	0	0	0
120	151	0	173	.	.	.	.	.	4	4	1.3	88	.	.	.	.	0	0	0
121	151	0	223	6	8	3	1.2	112	6	5	1.4	93	8	4	1.3	110	0	0	0
122	127	406	268	9	15	9	2.2	417	8	5	2.7	218	11	6	2.5	320	3	0	0
123	130	421	268	7	12	7	2.5	388	7	7	2 5	214	10	6	2.5	314	9	0	0
124	136	221	261	7	10	5	1.9	196	6	6	1.9	160	8	4	1.9	190	2	0	0
125	130	420	268	7	12	6	2.9	388	8	7	2.9	208	10	6	2.9	309	11	0	0
126	142	250	194	.	.	.	.	.	4	2	1.2	73	6	2	0.9	71	0	0	0
127	130	434	130	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
128	134	244	261	7	11	4	1.9	185	6	4	1.8	140	9	5	1.9	180	0	0	0
129	130	378	268	6	11	6	2.2	320	7	7	2.3	197	10	6	2.2	279	6	0	0
130	132	325	245	9	13	4	2.1	253	5	4	2.3	181	10	4	2.0	243	0	0	0
131	134	257	224	9	13	5	2.5	213	7	5	2.4	152	10	6	2.4	200	0	0	0
132	138	181	237	10	11	4	1.5	154	6	6	1.8	165	10	5	1.5	142	0	0	0
133	130	512	268	6	10	7	3.1	336	8	8	2.8	186	11	8	3.3	302	16	3	3
134	130	264	268	7	12	6	2.2	217	7	7	2.3	142	10	6	2.3	186	3	0	0
135	130	365	261	4	10	7	2.8	267	8	8	2.8	200	11	6	3.0	300	4	0	0
136	126	495	268	6	13	8	3.8	332	8	7	3.2	210	12	8	3.8	316	16	6	4
137	128	405	268	7	13	9	3 0	370	8	8	2.7	169	11	7	2.8	309	18	2	0
138	136	209	261	6	8	6	2.1	194	6	6	2.0	147	9	5	1.9	185	3	0	0
139	132	286	268	8	13	7	2.3	361	7	6	2.3	196	10	7	2.3	290	4	0	0
140	136	99 *	261	7	9	5	1.7	198	6	6	1.9	159	8	5	1.9	199	1	0	0
141	132	324	268	7	12	7	2.0	307	7	5	2.4	184	10	6	2.2	267	7	0	0
142	132	421	268	7	12	8	2.8	358	7	7	2.4	181	10	7	2.5	268	15	0	0
143	133	300	261	5	9	5	2.0	235	6	6	2.1	181	9	5	2.0	235	4	0	0
144	138	0	224	7	10	5	1.7	175	6	6	1.7	138	8	4	1.7	166	1	0	0
145	140	0	251	4	8	6	1.4	130	6	5	1.7	123	8	4	1.4	132	2	0	0
146	140	0	209	5	6	2	1.4	86	4	2	1.3	83	6	2	1.4	86	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens capensis continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
147	132	350	160	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
148	132	325	268	9	15	8	3.1	410	6	5	2.2	174	10	4	2.2	271	1	0	0
149	132	364	268	8	13	8	2.1	344	7	7	2.1	172	10	6	2.6	252	4	0	0
150	138	0	261	8	11	3	1.5	209	6	6	1.9	154	8	4	1.7	190	0	0	0
151	144	0	237	.	.	.	.	.	6	6	1.6	94	8	6	1.2	110	0	0	0
152	134	88	261	7	11	5	1.8	195	6	6	1.7	149	9	5	1.6	179	1	0	0
153	134	0	223	9	12	4	1.9	219	6	4	1.9	159	10	3	1.6	178	0	0	0
154	142	0	237	6	7	3	1.2	73	5	3	1.3	64	7	4	1.2	71	0	0	0
155	132	338	245	8	11	5	2.5	250	6	6	2.1	166	9	5	1.9	225	0	0	0
156	130	392	268	7	13	9	3.2	340	8	8	2.8	178	10	8	2.8	270	17	3	1
157	138	0	194	.	.	.	.	.	6	5	1.7	132	9	5	1.8	150	0	0	0
158	136	0	268	7	11	6	2.0	221	6	6	1.7	154	9	5	1.7	191	2	0	0
159	144	0	216	.	.	.	.	.	6	5	1.2	99	8	4	1.2	108	0	0	0
160	130	420	268	7	13	7	2.7	333	7	7	2.4	193	10	6	2.5	267	18	3	0
161	130	406	268	6	12	8	3.2	292	8	8	2.6	195	11	7	2.9	275	20	6	1
162	151	0	194	5	8	3	1.2	122	6	4	1.2	110	8	3	1.2	122	0	0	0
163	136	100	268	5	10	4	2.0	241	6	5	2.3	161	10	4	2.0	241	1	0	0
164	134	0	261	6	12	6	1.9	263	7	5	1.9	163	10	5	2.0	250	2	0	0
165	.	.	.	.	.	.	.	.	5	1	1.1	51	.	.	.	.	.	.	.
166	136	253	268	7	12	7	2.6	320	7	7	2.1	158	10	6	2.5	248	4	0	0
167	138	108	202	.	.	.	.	.	3	3	1.4	101	8	4	1.2	121	0	0	0
168	132	326	268	7	13	7	2.6	344	7	7	2.3	180	10	7	2.5	276	11	0	0
169	132	253	237	5	9	5	2.1	279	7	6	2.1	185	9	5	2.1	279	1	0	0
170	151	0	195	.	.	.	.	.	4	4	1.1	71	6	3	1.1	80	0	0	0
171	133	242	268	6	10	6	2.5	301	7	7	2.1	181	9	5	2.1	181	4	0	0
172	138	90 •	268	7	11	6	2.2	200	7	5	1.9	165	9	6	1.8	191	0	0	0
173	132	360	223	7	11	4	2.7	277	7	6	2.9	214	9	5	2.5	256	0	0	0
174	146	0	209	.	.	.	.	.	4	4	1.4	92	8	5	1.2	101	0	0	0
175	130	406	268	7	13	9	3.4	380	8	8	3.0	230	11	7	2.8	317	14	2	1
176	134	338	268	7	11	5	2.2	302	6	6	2.3	205	9	6	2.0	270	2	0	0
177	.	.	.	.	.	.	.	.	4	4	1.2	89	.	.	.	.	.	.	.
178	.	.	.	.	.	.	.	.	4	4	.	71	6	4	1.2	91	.	.	.
180	128	420	268	7	12	6	3.0	400	7	7	2.6	228	10	6	2.9	302	8	0	0
181	134	143	237	7	10	5	2.1	186	6	6	2.1	159	9	5	2.0	178	2	0	0
182	136	300	261	8	11	5	2.2	241	6	6	2.0	171	9	7	2.0	211	1	0	0
183	130	338	268	5	10	5	2.9	320	7	7	2.9	229	10	5	2.9	320	6	0	0
184	133	242	268	7	11	5	2.2	220	7	7	2.2	169	9	5	2.1	200	1	0	0
185	130	325	268	5	10	6	2.2	259	7	6	2.0	211	10	6	2.2	259	1	0	0
186	136	121 •	251	10	12	2	2.0	192	6	5	1.9	150	9	3	1.7	187	0	0	0
187	.	.	.	.	.	.	.	.	4	3	.	39	.	.	.	.	.	.	.
188	130	422	268	6	12	8	3.1	316	8	6	3.2	171	11	7	2.8	290	9	0	0
189	136	288	251	7	11	5	1.9	230	6	4	2.0	150	9	6	1.9	202	0	0	0
190	136	198	160 •	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
191	144	81	245	.	.	.	.	.	4	4	1.6	76	7	3	1.2	89	0	0	0
192	146	0	217	.	.	.	.	.	4	4	0.9	50	6	2	0.7	60	0	0	0
193	134	99 •	268	7	11	5	1.9	223	6	6	1.8	140	9	5	1.7	182	1	0	0
194	136	253	268	6	10	6	1.7	196	6	6	1.9	126	9	5	1.9	185	1	0	0
195	134	180	209	5	9	5	1.5	220	7	6	1.7	139	9	5	1.5	220	2	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens capensis continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
196	138	136	217	.	.	.	.	.	6	5	1.6	125	8	4	1.7	180	0	0	0
197	138	90 •	268	6	10	6	2.1	240	7	7	2.4	128	9	5	1.8	229	3	0	0
198	144	0	224	5	6	4	0.9	61	4	3	1.0	56	6	4	0.9	61	0	0	0
199	134	90 •	251	13	14	0	2.1	210	6	6	2.1	130	9	5	1.8	195	0	0	0
200	142	161	209	.	.	.	.	.	6	5	1.4	116	8	4	1.5	139	0	0	0
201	130	352	261	3	9	7	2.1	199	8	6	2.1	180	10	6	2.1	248	4	0	0
203	138	0	268	7	11	5	1.8	216	7	6	1.8	162	9	4	1.7	215	0	0	0
204	144	0	217	5	7	3	1.2	134	6	4	1.4	117	7	3	1.2	134	1	0	0
205	133	265	268	7	11	5	1.9	330	6	6	2.1	177	9	4	1.9	283	0	0	0
206	140	81 •	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
207	132	288	268	5	9	5	2.3	279	6	6	2.0	186	9	5	2.3	279	5	0	0
208	148	0	230	6	8	4	1.3	148	6	5	1.7	127	8	4	1.4	144	0	0	0
209	130	352	268	7	13	7	3.0	385	8	7	2.6	198	11	6	2.8	293	11	0	0
211	133	190	188	.	.	.	.	.	7	5	1.9	168	8	0	1.8	130	0	0	0
212	136	110 •	224	6	10	5	2.1	267	7	6	2.3	189	10	6	1.8	261	0	0	0
213	133	210	268	7	11	5	2.4	269	7	7	2.3	190	9	4	2.0	266	2	0	0
214	142	0	251	4	9	5	1.6	195	7	5	1.8	170	10	6	1.7	199	0	0	0
215	144	0	166	.	.	.	.	.	6	5	.	.	.	.	.	.	0	0	0
216	151	0	237	.	.	.	.	.	6	4	1.9	94	8	3	1.4	106	0	0	0
217	136	132 •	268	7	12	7	2.1	335	7	7	2.3	170	10	6	2.0	259	2	0	0
218	132	168 •	261	7	12	6	2.3	225	7	7	2.4	175	10	6	2.3	207	2	0	0
219	130	351	261	7	13	7	3.2	393	8	8	2.9	213	10	6	3.0	300	6	0	0
220	151	0	230	.	.	.	.	.	6	4	1.2	169	8	4	1.5	109	0	0	0
221	130	434	268	7	14	10	3.4	396	8	7	3.0	212	11	7	3.1	306	11	3	1
222	134	64 •	237	.	.	.	.	.	6	5	1.9	172	8	5	1.9	208	0	0	0
223	136	120 •	202	.	.	.	.	.	6	6	1.9	191	8	4	1.9	251	0	0	0
224	132	338	209	7	12	5	2.3	158	8	4	2.0	129	10	4	2.0	149	0	0	0
225	138	100 •	261	7	10	4	1.9	178	6	6	1.9	136	9	5	1.8	178	0	0	0
226	134	221	268	6	10	5	2.2	212	7	5	2.1	173	9	5	2.0	216	3	0	0
227	136	190	268	4	9	7	1.9	237	7	7	1.7	170	11	7	1.7	280	4	0	0
228	136	128	237	5	8	4	1.6	167	6	5	1.7	182	8	4	1.6	167	1	0	0
229	132	392	268	7	12	5	2.2	369	7	7	2.4	141	10	5	2.4	289	6	0	0
230	132	265	268	7	12	6	2.2	276	7	5	2.4	191	10	5	2.0	262	0	0	0
231	132	363	268	7	12	6	2.7	356	7	4	2.8	205	10	5	2.5	291	2	0	0
232	133	190	261	9	13	6	1.8	202	7	5	1.7	170	9	5	1.4	186	0	0	0
233	130	347	268	7	14	8	3.4	390	8	6	3.2	209	11	7	3.1	315	9	0	0
234	132	242	261	10	14	5	1.9	289	7	5	2.4	195	10	4	2.0	265	1	0	0
235	142	0	217	.	.	.	.	.	6	5	1.4	98	8	3	1.0	101	0	0	0
236	138	100 •	209	7	10	3	1.6	130	6	5	1.9	111	9	5	1.5	132	0	0	0
237	126	420	268	7	14	8	2.9	397	8	6	2.8	226	11	7	2.8	311	10	0	0
238	130	0	268	8	12	5	2.0	260	8	6	2.3	203	10	6	2.0	249	2	0	0
239	128	339	268	7	13	6	2.5	348	8	5	2.9	218	11	6	2.8	304	2	0	0
240	.	.	.	.	.	.	.	.	4	2	1.3	80	.	.	.	.	.	.	.
241	128	350	268	6	13	7	3.3	328	9	7	3.2	215	12	8	3.1	307	7	0	0
242	130	287	261	7	12	6	2.9	386	7	6	3.0	220	10	6	3.0	308	2	0	0
243	144	0	209	.	.	.	.	.	6	5	1.4	136	8	3	1.7	160	0	0	0
244	138	128	237	8	11	4	1.6	182	6	5	1.8	150	8	3	1.9	174	0	0	0
245	136	128	209	.	.	.	.	.	6	4	1.7	143	9	4	1.9	164	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens capensis continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
246	.	.	.	5	6	2	0.9	61	4	4	1.2	53	6	2	0.9	61	.	.	.
247	136	171	261	7	10	3	1.8	233	6	6	1.9	150	9	5	1.6	223	0	0	0
248	133	231	245	7	12	5	2.3	280	7	5	2.3	180	10	5	2.3	249	0	0	0
249	.	.	.	.	.	.	.	.	4	4	1.2	80	6	2	0.9	83	.	.	.
250	144	0	217	5	8	3	1.2	61	4	2	1.1	51	8	3	1.2	61	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of Impatiens pallida (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
1	130	718	268	4	8	8	3.6	493	7	7	3.3	359	10	11	4.3	524	18	2	2
2	130	882	212	4	9	9	4.4	506	7	7	3.6	359	10	12	4.9	555	3	0	0
3	136	372	170	.	.	.	.	.	4	4	1.7	138	.	.	.	.	0	0	0
4	142	0	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
5	132	566	268	2	7	7	3.5	294	7	7	3.5	294	9	10	4.1	461	13	0	0
7	130	560	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
8	138	442	205	6	7	5	1.5	130	5	5	1.5	147	7	5	1.4	140	0	0	0
9	130	765	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
10	136	463	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
11	132	462	205	4	6	6	2.0	244	5	5	1.8	228	7	6	2.1	247	0	0	0
12	130	552	185	.	.	.	.	.	6	6	3.1	350	.	.	.	.	0	0	0
13	130	640	170	.	.	.	.	.	5	5	2.3	232	.	.	.	.	0	0	0
14	136	425	191	4	5	5	1.4	142	4	4	1.9	149	6	4	1.9	140	0	0	0
15	130	731	170	.	.	.	.	.	6	6	3.1	297	.	.	.	.	0	0	0
16	144	210	177	.	.	.	.	.	3	3	1.3	89	.	.	.	.	0	0	0
17	132	555	191	3	6	6	2.4	324	6	6	2.5	301	8	7	3.2	320	0	0	0
18	132	552	177	.	.	.	.	.	5	5	2.2	225	.	.	.	.	0	0	0
19	136	351	170	.	.	.	.	.	4	4	1.6	126	.	.	.	.	0	0	0
20	127	799	212	2	7	7	3.0	360	7	7	3.0	360	10	10	3.4	444	3	0	0
21	132	609	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
22	132	624	219	4	7	7	2.4	330	6	6	2.5	302	8	8	2.5	320	1	0	0
23	130	1080	240	4	9	9	4.2	547	7	7	4.3	399	10	12	4.6	600	11	0	0
24	132	473	240	3	6	6	2.1	303	5	5	2.0	293	7	6	2.1	314	1	0	0
25	132	661	219	3	7	7	2.8	452	6	6	2.4	398	8	8	2.8	479	1	0	0
26	128	875	198	2	7	6	3.2	349	7	6	3.2	349	9	6	3.4	431	1	0	0
27	133	429	212	5	6	6	1.9	235	5	5	1.6	238	6	6	1.9	235	0	0	0
28	140	228	185	.	.	.	.	.	4	4	1.1	81	.	.	.	.	0	0	0
29	130	704	198	3	8	8	2.7	449	6	6	2.8	387	9	8	3.2	484	0	0	0
30	128	799	219	3	8	8	3.6	493	7	7	3.2	410	10	10	4.3	629	3	0	0
31	136	341	226	3	5	5	1.5	173	5	5	1.5	169	6	5	1.5	169	0	0	0
32	132	710	191	4	7	6	3.0	498	6	6	2.9	411	8	6	3.4	526	0	0	0
33	132	656	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
34	130	897	205	5	8	6	3.0	551	6	5	2.5	412	8	6	3.0	551	1	0	0
35	128	990	268	3	9	9	3.7	529	7	7	3.6	461	11	18	5.2	683	19	12	11
36	133	416	198	4	6	6	1.3	174	5	5	1.8	172	6	6	1.7	173	0	0	0
37	134	570	177	.	.	.	.	.	5	5	2.6	282	.	.	.	.	0	0	0
38	132	480	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
39	136	523	185	2	5	5	1.8	179	5	5	1.8	179	.	.	.	.	0	0	0
40	136	510	191	.	.	.	.	.	4	4	1.7	173	6	4	2.0	168	0	0	0
41	134	610	177	.	.	.	.	.	5	5	1.9	272	.	.	.	.	0	0	0
42	132	789	205	5	8	6	2.8	406	6	5	2.5	385	8	6	2.8	406	0	0	0
43	136	519	233	3	7	5	2.3	160	5	5	2.0	161	6	4	1.8	167	0	0	0
44	130	566	177	2	6	6	1.9	220	6	6	1.9	220	.	.	.	.	0	0	0
45	130	888	177	3	7	6	3.0	410	6	5	3.0	364	.	.	.	.	0	0	0
46	134	494	177	3	6	6	2.0	235	5	5	2.0	197	.	.	.	.	0	0	0
47	130	736	268	4	9	7	3.8	526	7	6	3.5	396	10	8	4.0	580	6	0	0
48	130	1226	268	3	10	9	4.8	519	8	8	5.1	429	12	17	5.3	671	34	19	9
49	132	415	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of Impatiens pallida continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
50	130	956	170	.	.	.	.	.	7	6	3.6	392	.	.	.	.	0	0	0
51	130	1000	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
52	138	332	268	2	6	6	1.8	181	6	6	1.8	181	8	6	2.0	240	9	0	0
53	130	1051	185	2	8	8	5.9	469	8	8	5.9	469	.	.	.	.	1	0	0
55	130	1225	191	2	8	8	6.0	487	8	8	6.0	487	11	13	7.0	648	0	0	0
56	136	566	268	3	7	7	3.1	337	7	7	2.3	287	10	10	3.4	360	19	1	1
57	144	198	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
59	140	348	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
60	140	509	163	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
61	132	1029	185	3	9	9	4.8	547	8	8	4.9	436	.	.	.	.	0	0	0
62	133	859	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
63	136	390	268	4	7	7	2.3	236	5	5	1.9	213	8	7	2.4	249	10	0	0
64	130	777	268	3	9	8	4.1	530	8	8	4.2	433	11	14	5.1	680	26	22	15
65	132	590	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
66	132	346	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
67	136	413	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
69	140	0	146	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
70	136	525	170	.	.	.	.	.	6	5	2.6	152	.	.	.	.	0	0	0
71	130	672	170	.	.	.	.	.	6	6	2.9	193	.	.	.	.	0	0	0
72	130	1014	185	3	9	9	5.0	571	8	8	4.4	505	.	.	.	.	0	0	0
73	126	1232	268	4	11	17	7.2	762	9	9	5.8	541	12	26	8.2	817	43	82	67
74	140	200	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
75	130	760	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
76	136	525	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
77	132	851	226	2	7	7	3.5	429	7	7	3.5	429	11	14	4.5	620	8	2	4
78	132	425	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
79	128	1247	191	3	10	11	6.5	608	9	9	5.4	504	11	15	8.3	660	0	0	0
80	130	702	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
82	136	338	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
83	136	900	177	.	.	.	.	.	6	6	4.1	232	.	.	.	.	0	0	0
84	130	595	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
85	130	816	268	2	9	9	4.6	411	9	9	4.6	411	12	29	8.0	699	60	57	46
86	133	324	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
88	130	748	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
89	132	620	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
90	134	336	146	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
91	130	518	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
96	130	833	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
97	136	375	191	2	5	5	2.0	209	5	5	2.0	209	8	6	2.9	239	0	0	0
98	136	315	185	.	.	.	.	.	5	5	1.6	170	.	.	.	.	0	0	0
99	136	348	226	3	6	6	2.4	268	6	6	1.9	231	8	8	2.3	290	2	0	0
100	136	342	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
101	127	1060	198	4	11	16	8.9	516	9	9	6.5	427	12	21	9.2	533	0	0	0
102	132	608	240	4	8	8	3.2	390	6	6	2.3	340	9	10	3.3	410	7	1	0
103	140	238	142	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
104	132	438	142	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
105	128	920	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
106	134	294	144	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of Impatiens pallida continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
107	130	574	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
108	130	504	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
109	126	760	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
110	134	448	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
112	130	794	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
114	128	976	138	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
115	128	748	268	2	7	7	3.3	447	7	7	3.3	447	10	8	4.2	564	24	8	6
116	128	918	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
117	130	768	268	2	8	8	4.0	501	8	8	4.0	501	10	13	5.2	680	18	0	0
118	130	788	268	2	8	7	3.6	434	8	7	3.6	434	10	11	4.9	528	36	15	10
119	128	644	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
120	130	1005	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
121	136	413	163	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
122	140	145	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
123	133	450	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
125	136	555	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
126	126	1040	226	3	10	13	6.6	620	9	9	5.3	522	12	39	9.4	814	19	5	2
127	136	432	170	.	.	.	.	.	6	6	2.5	210	.	.	.	.	0	0	0
128	130	478	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
129	140	238	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
132	134	217	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
133	136	656	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
134	136	625	170	2	7	7	3.5	340	7	7	3.5	340	.	.	.	.	0	0	0
135	132	782	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
137	128	554	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
138	133	230	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
139	130	726	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
141	126	1018	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
142	127	1053	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
144	130	646	146	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
145	127	1012	147	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
146	130	1340	142	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
147	138	264	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
149	133	455	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
152	133	544	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
155	142	263	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
156	133	608	134	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
158	133	680	198	5	9	7	2.3	220	6	6	1.9	190	9	7	2.3	220	0	0	0
159	132	648	134	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
163	127	822	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
164	130	463	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
165	126	660	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
166	130	672	191	3	8	6	2.5	374	6	4	2.6	345	9	7	3.6	398	0	0	0
169	126	1000	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
172	136	330	163	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
173	127	936	185	3	9	8	5.7	519	8	8	5.3	449	.	.	.	.	0	0	0
174	130	720	177	.	.	.	.	.	7	7	3.3	163	.	.	.	.	0	0	0
175	130	756	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of Impatiens pallida continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
176	132	682	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
177	134	425	134	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
178	136	418	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
179	132	600	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
180	140	238 *	148	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
181	140	190	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
182	136	631	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
183	132	400	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
185	133	312	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
186	132	377	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
187	133	495	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
188	130	390	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
190	140	340	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
191	127	1247	177	3	10	12	8.2	455	10	10	7.0	466	.	.	.	.	0	0	0
192	130	639	191	2	7	7	4.4	424	7	7	4.4	424	10	8	5.0	496	1	0	0
193	126	970	185	.	.	.	.	.	7	7	4.5	362	.	.	.	.	0	0	0
196	130	828	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
197	130	585	177	.	.	.	.	.	6	6	2.5	391	.	.	.	.	0	0	0
198	130	559	240	4	9	9	4.5	522	7	7	3.2	410	10	14	4.2	562	7	0	0
199	130	378 *	177	3	6	5	2.3	240	6	6	2.8	230	.	.	.	.	0	0	0
200	126	1169	198	5	2	9	6.0	419	2	2	5.6	419	2	9	6.0	419	0	0	0
202	134	432	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
203	132	636	198	2	7	7	3.7	411	7	7	3.7	411	10	8	4.0	473	2	0	0
205	134	384	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
206	127	414 *	170	.	.	.	.	.	6	5	3.7	300	.	.	.	.	0	0	0
207	140	288	148	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
208	136	425	177	.	.	.	.	.	5	5	2.1	166	.	.	.	.	0	0	0
210	130	651	177	.	.	.	.	.	7	6	3.7	266	.	.	.	.	0	0	0
212	134	460	198	3	7	7	3.0	328	6	6	2.5	298	9	7	3.6	356	1	0	0
213	133	394	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
216	133	336	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
217	127	666	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
218	130	1093	170	.	.	.	.	.	.	.	5.5	350	.	.	.	.	0	0	0
219	142	263	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
220	133	504	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
221	130	532	185	3	8	8	4.2	444	7	7	3.4	441	.	.	.	.	0	0	0
223	130	944	170	.	.	.	.	.	7	7	4.2	248	.	.	.	.	0	0	0
224	132	882	205	4	11	17	8.2	699	8	8	6.0	486	13	29	9.8	764	1	0	0
226	140	240	185	.	.	.	.	.	5	5	1.5	133	.	.	.	.	0	0	0
227	128	966	185	.	.	.	.	.	8	8	4.5	275	.	.	.	.	0	0	0
228	130	630	170	.	.	.	.	.	.	.	2.6	159	.	.	.	.	0	0	0
229	136	341	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
230	130	902	185	2	8	8	5.7	550	8	8	5.7	550	.	.	.	.	1	0	0
231	132	645	268	3	8	8	3.7	486	7	7	3.3	261	10	11	3.7	540	21	3	2
232	133	210	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
233	132	384	170	.	.	.	.	.	5	3	2 2	199	.	.	.	.	0	0	0
234	130	888	177	.	.	.	.	.	2	2	5.8	460	.	.	.	.	0	0	0
235	126	675	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 1 of _Impatiens_ _pallida_ continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
236	138	525	185	3	6	6	2.1	185	5	5	2.0	168	.	.	.	.	0	0	0
238	138	375	185	2	5	5	1.7	180	5	5	1.7	180	.	.	.	.	0	0	0
239	130	1034	198	4	11	23	8.3	676	8	8	6.0	499	12	35	9.8	760	0	0	0
240	130	752	268	3	9	9	4.2	509	8	8	4.8	452	11	15	6.0	638	24	16	11
241	130	759	154	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
242	134	630	161	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
243	132	851	191	.	.	.	.	.	8	8	5.6	534	2	8	6.2	394	0	0	0
244	132	620	170	.	.	.	.	.	6	6	2.8	342	.	.	.	.	0	0	0
245	138	478	191	4	7	7	2.1	230	5	5	2.2	228	8	6	2.0	230	0	0	0
246	130	1320	268	2	10	11	7.8	586	10	11	7.8	586	13	53	12.3	900	66	74	49
247	134	419	198	3	7	7	2.8	275	6	6	2.6	261	9	8	3.6	311	1	0	0
250	133	429	170	.	.	.	.	.	7	7	4.0	330	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens pallida (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
3	130	700	176	2	8	6	4.7	264	8	6	4.7	264	.	.	.	.	0	0	0
5	132	710	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
6	132	1071	155	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
7	130	995	197	4	11	22	6.9	609	8	8	5.7	459	13	35	6.5	673	3	1	0
8	130	940	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
9	132	731	205	3	9	10	5.0	415	8	8	5.2	377	12	20	5.5	506	0	1	0
10	130	981	205	4	2	8	5.6	229	2	2	5.5	227	2	8	6.4	239	0	0	0
11	127	1380	190	3	11	7	7.4	435	10	8	7.3	405	10	10	7.6	461	0	0	0
12	130	945	233	3	11	13	7.0	632	10	10	6.7	544	13	32	7.5	796	7	11	9
13	132	697	197	3	9	9	5.2	510	8	8	4.6	479	11	12	4.4	520	0	0	0
14	132	694	205	3	9	9	4.8	539	8	8	5.3	476	11	17	6.0	641	2	0	0
15	136	540	205	4	8	7	2.8	400	6	6	2.5	230	9	7	3.0	320	0	0	0
16	140	250	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
17	134	504	233	4	9	7	3.2	402	7	7	3.2	328	10	9	3.3	432	1	0	0
18	136	585	190	3	7	6	3.3	371	6	6	3.2	392	9	7	4.4	326	0	0	0
19	136	570	155	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
20	132	1078	176	.	.	.	.	.	7	5	3.7	260	.	.	.	.	0	0	0
21	132	652	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
22	138	435	155	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
23	130	777	169	.	.	.	.	.	6	2	2.9	110	.	.	.	.	0	0	0
24	133	620	155	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
25	133	450	233	3	8	8	3.4	390	7	7	3.3	323	9	14	4.0	518	0	0	0
26	130	1050	212	4	12	29	6.9	618	9	9	6.0	505	13	39	7.9	708	1	6	1
27	136	442	176	.	.	.	.	.	6	6	2.3	188	.	.	.	.	0	0	0
28	142	162	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
29	138	705	190	4	9	7	2.6	280	8	7	2.6	232	10	6	3.2	290	0	0	0
30	132	696	205	4	9	9	3.8	450	7	7	4.0	331	10	11	4.7	528	0	1	0
31	132	918	205	3	9	9	5.6	540	8	8	5.2	450	12	24	5.7	748	2	1	1
32	132	652	268	4	9	9	3.7	340	7	7	3.2	253	10	12	3.6	387	4	5	0
33	125	1230	205	3	11	27	8.9	669	10	15	8.0	582	14	49	11.3	801	6	2	1
34	132	540	176	.	.	.	.	.	8	8	4.6	385	.	.	.	.	0	0	0
35	142	168	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
36	128	1266	176	.	.	.	.	.	8	8	4.6	242	.	.	.	.	0	0	0
37	132	560	155	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
38	130	900	176	3	8	8	4.3	251	8	8	4.6	266	.	.	.	.	0	0	0
39	130	1156	184	4	9	7	6.0	393	8	8	6.1	387	.	.	.	.	0	0	0
40	133	697	190	3	7	7	3.0	380	6	6	3.0	370	8	2	3.2	381	0	0	0
41	132	688	197	4	8	6	3.1	472	6	6	3.1	418	9	6	3.2	486	0	0	0
42	132	555	197	3	6	6	2.3	308	6	6	2.6	365	9	7	2.3	363	1	0	0
43	132	753	190	3	8	7	4.1	523	7	7	4.0	503	10	7	4.5	525	0	0	0
44	130	852	268	3	9	9	5.2	580	8	8	5.1	508	12	20	6.1	686	2	22	11
45	140	870	190	3	7	7	2.5	285	6	6	2.4	263	9	2	2.5	267	0	0	0
46	136	416	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
47	130	1127	155	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
48	132	720	185	.	.	.	.	.	6	5	2.5	305	.	.	.	.	0	0	0
49	138	420	197	5	7	5	1.9	190	5	5	2.1	210	7	5	1.9	190	0	0	0
50	140	390	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
51	136	608	205	6	8	5	2.3	211	6	6	2.0	192	8	6	2.1	211	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens pallida continued (see page 41 for key).

PL	DE	CA	DD	W	NO	LO	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
52	132	697	197	3	9	7	3.6	491	8	8	3.6	452	11	9	3.8	520	1	0	0
53	130	805	185	.	.	.	.	.	9	9	4.9	530	.	.	.	.	0	0	0
55	140	558	185	.	.	.	.	.	5	5	1.8	216	.	.	.	.	0	0	0
56	130	898	197	2	9	9	5.2	563	9	9	5.2	563	12	21	6.7	736	2	0	0
57	132	940	226	4	9	7	4.3	552	7	7	3.7	463	10	8	2.0	581	0	0	0
58	140	299	197	6	6	2	2.0	126	4	4	1.2	133	6	4	4.3	148	0	0	0
59	136	450	190	5	7	5	2.2	242	5	5	1.9	240	7	5	2.2	242	0	0	0
60	134	609	197	5	8	5	2.8	322	6	6	2.3	285	8	5	2.8	322	0	0	0
61	132	766	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
62	130	1097	268	3	10	10	5.5	645	9	9	5.2	557	12	18	6.0	792	5	9	3
63	130	644	185	3	8	7	3.4	360	6	6	3.4	319	.	.	.	.	0	0	0
64	132	980	219	3	8	8	3.8	358	7	7	4.3	333	10	8	3.8	400	1	0	0
65	127	1026	197	5	2	5	6.3	470	2	2	5.8	466	2	5	6.3	470	0	0	0
66	134	504	205	5	8	6	2.6	370	6	6	3.3	320	8	6	2.6	370	0	0	0
67	130	777	226	3	8	8	3.7	460	7	7	3.6	439	10	9	3.8	512	0	0	0
68	132	416	176	3	6	6	2.1	261	6	6	2.1	257	.	.	.	.	0	0	0
69	127	1239	134	5	9	7	2.7	388	6	6	2.6	345	9	7	2.7	388	0	0	0
70	133	495	205	3	7	7	2.7	376	6	6	2.8	347	9	5	2.8	425	0	0	0
71	132	630	205	4	8	6	2.8	400	6	6	3.1	363	9	5	2.9	407	0	0	0
72	130	1155	185	3	9	7	4.7	605	8	8	4.7	553	.	.	.	.	0	0	0
73	132	726	190	5	9	4	3.0	322	7	7	3.0	352	9	4	3.0	322	0	0	0
74	132	748	190	5	9	6	2.8	425	7	7	3.1	378	9	6	2.8	425	0	0	0
75	130	651	197	3	8	6	3.2	372	7	7	3.1	353	10	7	3.4	397	0	0	0
76	132	732	185	3	8	5	2.7	323	7	5	2.9	311	.	.	.	.	0	0	0
77	130	727	212	3	8	7	3.5	450	7	6	3.2	416	10	6	3.7	508	1	0	0
78	128	858	190	3	9	9	4.5	686	8	8	4.7	500	2	0	4.8	460	0	0	0
79	133	922	205	5	9	6	3.0	310	6	5	2.9	290	9	6	3.0	310	0	0	0
80	134	555	190	4	7	6	2.3	251	6	6	2.3	235	8	5	2.1	248	0	0	0
81	132	704	240	4	9	8	4.3	620	7	7	3.5	481	10	8	4.1	682	2	1	0
82	130	918	185	3	9	9	5.1	625	8	8	5.4	569	.	.	.	.	0	0	0
83	140	313	190	5	6	3	1.4	109	4	4	1.3	103	6	3	1.4	109	0	0	0
85	127	1160	197	4	11	13	7.8	713	8	8	6.7	577	12	15	7.6	805	0	0	0
86	132	858	219	2	6	6	3.2	429	6	6	3.2	429	9	7	3.5	489	3	0	0
87	136	323	176	.	.	.	.	.	4	4	1.6	168	.	.	.	.	0	0	0
88	127	975	197	4	10	8	5.0	630	8	8	4.7	534	10	9	5.3	627	0	0	0
89	132	714	212	3	7	6	2.7	472	6	6	2.7	355	9	6	3.2	410	1	0	0
90	132	577	185	2	6	6	2.5	350	6	6	2.5	350	.	.	.	.	0	0	0
91	144	143	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
92	136	455	176	.	.	.	.	.	5	5	1.8	229	.	.	.	.	0	0	0
93	132	788	219	3	8	8	3.2	470	6	6	3.2	433	9	7	3.7	520	0	0	0
94	132	828	205	2	7	7	3.1	427	7	7	3.1	427	9	7	3.4	500	0	0	0
95	142	534	169	.	.	.	.	.	6	4	1.4	131	.	.	.	.	0	0	0
96	142	264	185	.	.	.	.	.	2	2	1.1	118	.	.	.	.	0	0	0
97	132	828	219	4	8	6	3.0	414	6	6	3.3	376	9	6	3.1	424	0	0	0
98	138	476	197	4	7	5	2.2	196	6	6	2.0	192	7	3	2.0	199	0	0	0
99	132	861	233	4	10	8	4.6	677	8	8	4.5	542	11	12	4.8	715	0	0	0
100	134	518	190	5	2	0	2.2	230	6	6	2.2	240	2	0	2.2	230	0	0	0
101	136	576	197	4	7	6	2.3	311	5	5	2.4	310	8	5	2.5	325	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens pallida continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
102	136	342	205	5	7	4	1.9	162	6	6	2.0	160	7	4	1.9	162	0	0	0
103	132	608	185	4	7	5	2.4	330	6	6	2.6	334	.	.	.	.	0	0	0
104	130	651	212	4	8	6	2.7	366	5	4	2.9	327	9	6	2.8	390	0	0	0
105	130	1146	233	4	10	7	4.5	693	8	8	4.0	561	11	12	4.7	738	1	1	1
106	130	864	212	2	8	8	4.1	501	8	8	4.1	501	11	9	4.2	576	1	0	0
107	127	907	268	4	10	9	5.6	714	8	8	5.3	590	11	13	5.5	764	2	14	5
108	132	784	190	4	10	8	4.7	585	8	8	4.5	489	10	6	4.9	570	0	0	0
109	130	864	268	4	10	10	5.0	729	8	8	4.7	552	12	19	5.2	810	7	24	13
110	130	964	205	4	10	10	4.6	688	8	8	4.5	567	11	14	5.2	737	1	0	0
111	132	683	176	.	.	.	.	.	7	7	3.0	337	.	.	.	.	0	0	0
112	127	912	197	4	10	8	4.9	624	8	8	4.2	558	11	8	4.5	638	0	0	0
113	130	1034	233	3	9	9	4.8	661	8	8	4.2	578	11	13	5.4	810	2	4	2
114	126	1050	233	2	9	9	4.6	582	9	9	4.6	582	12	19	5.0	768	13	4	2
115	132	570	219	3	7	7	2.5	317	6	6	2.7	292	9	6	2.6	318	0	0	0
116	128	882	233	2	8	8	4.6	608	8	8	4.6	608	11	12	5.1	810	1	2	0
117	132	889	205	4	9	8	3.5	523	7	7	3.3	455	10	8	3.6	539	0	0	0
118	130	757	219	5	9	6	3.3	440	7	7	3.4	425	9	6	3.3	440	0	0	0
119	136	493	205	4	6	5	1.6	186	4	4	1.7	189	7	4	1.7	193	0	0	0
120	136	403	185	.	.	.	.	.	5	5	2.3	175	.	.	.	.	0	0	0
121	126	1261	268	3	10	9	5.8	688	9	9	6.2	596	12	17	6.3	850	6	18	7
122	132	774	212	5	8	5	2.7	364	6	6	2.9	311	8	5	2.7	364	0	0	0
123	130	964	219	5	10	8	4.0	554	8	8	3.6	526	10	8	4.0	554	0	0	0
124	130	660	212	4	8	7	3.0	437	7	7	2.8	395	9	7	2.6	464	0	0	0
125	133	683	190	4	7	5	2.1	199	6	6	1.9	195	8	5	2.1	200	0	0	0
126	132	840	205	3	8	8	3.0	419	7	7	3.3	381	10	7	3.4	436	0	0	0
127	133	756	205	3	6	6	2.4	309	6	6	2.5	291	8	6	2.7	312	0	0	0
128	130	774	240	3	8	7	3.4	498	7	7	3.2	454	10	7	3.4	512	1	0	0
129	132	672	233	5	9	7	3.0	419	6	6	2.8	388	9	7	3.0	419	0	0	0
130	132	646	205	4	8	8	3.0	408	6	6	2.9	398	8	6	2.9	413	0	0	0
131	130	644	219	4	9	8	3.3	450	7	7	2.8	375	10	9	3.3	500	0	0	0
132	128	995	219	3	9	9	4.4	662	8	8	4.1	559	11	10	4.4	780	0	0	0
133	130	956	233	4	9	8	3.9	649	8	8	4.0	523	10	9	3.9	663	2	0	0
134	133	718	191	3	8	8	2.9	343	7	7	3.0	312	9	3	2.5	336	0	0	0
135	132	680	191	4	9	7	3.2	348	7	7	3.1	299	7	5	3.3	349	0	0	0
136	130	731	233	3	8	8	4.2	610	8	8	4.1	517	10	9	4.4	695	4	0	0
137	130	869	268	2	8	8	5.4	545	8	8	5.4	545	12	19	6.2	838	12	25	16
138	130	1000	205	4	10	10	5.1	729	8	8	4.8	560	12	14	5.4	793	1	0	0
139	132	964	268	3	9	9	4.3	657	8	8	4.2	560	11	13	4.7	800	4	5	1
141	130	678	219	3	8	7	4.1	559	8	8	3.9	521	10	9	4.0	590	2	0	0
142	130	1029	226	4	9	7	4.4	578	8	8	4.4	505	9	8	4.7	551	1	0	0
143	132	771	226	4	8	7	2.8	362	6	6	2.6	323	9	8	2.9	372	0	0	0
144	122	1178	268	2	11	11	6.2	622	11	11	6.2	622	12	24	8.1	879	8	52	26
145	132	742	205	2	7	7	3.0	411	7	7	3.0	411	10	8	3.2	453	0	0	0
146	130	1118	240	3	9	9	4.3	650	8	8	3.9	548	12	12	5.7	773	2	2	1
147	132	748	212	4	7	6	2.5	215	6	6	2.6	208	8	6	2.4	219	0	0	0
148	142	220	169	.	.	.	.	.	4	4	1.0	87	.	.	.	.	0	0	0
149	132	760	169	.	.	.	.	.	6	6	2.4	395	.	.	.	.	0	0	0
150	136	920	169	.	.	.	.	.	6	6	3.1	290	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of *Impatiens pallida* continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
151	132	860	268	4	9	7	3.5	632	7	7	3.6	550	10	8	3.4	659	1	0	0
152	134	585	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
153	130	940	248	4	10	9	5.1	749	8	8	4.5	577	12	15	5.2	820	4	18	9
154	130	818	191	.	.	.	.	.	7	7	3.9	565	8	4	.	630	0	0	0
155	130	980	240	4	10	9	4.7	734	8	8	4.3	564	11	11	4.8	799	2	2	1
156	130	756	219	4	9	9	3.6	463	7	7	3.4	410	10	9	1.8	456	0	0	0
157	136	558	205	3	6	6	1.5	198	6	6	1.9	191	8	6	3.5	202	1	0	0
158	132	753	226	4	9	8	2.9	398	7	7	2.8	326	9	7	3.0	390	1	0	0
159	130	600	233	4	9	7	3.9	619	8	8	4.1	525	10	9	4.2	634	5	0	0
160	130	907	248	4	10	8	4.4	670	8	8	4.2	528	11	12	5.0	747	4	2	1
161	130	1071	268	4	11	13	6.0	760	9	9	5.1	574	12	25	6.3	853	12	36	24
162	138	450	185	.	.	.	.	.	5	5	1.8	149	.	.	.	.	0	0	0
163	136	198	185	.	.	.	.	.	6	6	2.2	156	.	.	.	.	0	0	0
164	130	624	240	4	10	8	4.3	559	8	8	4.0	493	11	9	4.3	589	2	0	0
165	134	600	191	2	6	6	2.3	257	6	6	2.3	257	9	7	3.0	282	1	0	0
166	132	869	268	4	8	7	2.0	558	7	7	3.0	476	9	7	3.7	563	4	0	0
167	132	672	176	2	7	7	3.7	466	7	7	3.7	466	.	.	.	.	0	0	0
168	142	735	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
169	142	158	191	4	5	2	1.1	77	3	2	1.1	63	4	1	1.1	55	0	0	0
170	132	880	177	.	.	.	.	.	6	6	3.1	451	.	.	.	.	0	0	0
171	132	736	177	.	.	.	.	.	7	7	3.5	483	.	.	.	.	0	0	0
172	132	852	169	.	.	.	.	.	7	7	5.0	320	.	.	.	.	0	0	0
173	140	120 •	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
175	146	136	205	.	.	.	.	.	2	2	0.8	62	4	1	0.7	51	0	0	0
176	134	394	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
177	136	270	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
178	138	304	185	.	.	.	.	.	4	4	1.5	143	.	.	.	.	0	0	0
179	132	497	197	4	8	6	2.4	261	6	6	2.4	233	8	6	2.7	257	0	0	0
181	132	698	177	3	7	7	2.8	288	7	7	2.8	285	.	.	.	.	0	0	0
182	140	286	185	.	.	.	.	.	6	6	1.3	119	.	.	.	.	0	0	0
183	130	1056	191	3	10	9	5.6	661	9	9	5.4	576	12	13	6.1	720	0	0	0
184	132	506	177	.	.	.	.	.	7	7	2.9	391	.	.	.	.	0	0	0
185	132	694	197	4	9	7	3.6	475	7	7	3.2	389	9	7	4.3	469	0	0	0
186	134	377	240	4	7	5	1.7	203	6	6	1.8	197	8	4	1.8	231	1	0	0
187	130	880	191	4	10	8	4.9	590	8	8	4.7	530	11	10	5 2	570	0	0	0
188	130	624 •	185	4	9	7	3.6	446	8	8	3.8	450	.	.	.	.	0	0	0
189	130	1078	268	4	9	9	4.5	670	8	8	4.1	500	10	9	4.5	729	2	1	0
190	133	416	169	.	.	.	.	.	5	5	2.4	228	.	.	.	.	0	0	0
191	133	448	205	5	6	3	2.0	197	5	5	2.0	184	6	3	2.0	197	0	0	0
192	130	819	197	3	9	9	4.8	597	8	8	4.7	531	11	12	6.7	649	0	0	0
193	133	645	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
194	134	604	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
195	136	558	185	.	.	.	.	.	6	6	1.9	182	.	.	.	.	0	0	0
196	140	171	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
197	130	378	191	4	8	6	2.7	313	6	6	2.6	309	9	7	2.8	292	0	0	0
198	134	510	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
199	136	210 •	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
200	130	757	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0

APPENDIX 4. Raw field data collected from quadrat 2 of Impatiens pallida continued (see page 41 for key).

PL	DE	CA	DD	W	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2	A	B	C
201	130	814	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
202	133	403	191	3	6	3	1.9	270	5	5	2.0	276	7	5	2.0	287	0	0	0
203	130	931	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
204	134	344	177	.	.	.	.	.	6	5	2.0	265	.	.	.	.	0	0	0
205	130	823	268	3	9	9	5.0	612	8	8	4.6	534	11	17	5.7	783	4	10	3
206	136	130 *	185	.	.	.	.	.	2	2	1.1	135	.	.	.	.	0	0	0
207	126	864	268	4	11	16	6.8	797	9	9	6.0	573	12	24	8.4	868	7	50	20
208	130	391	146	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
209	130	726	268	3	9	9	4.7	647	8	8	4.2	569	11	14	6.0	790	9	17	8
210	132	627	169	.	.	.	.	.	6	6	3.2	313	.	.	.	.	0	0	0
211	132	643	177	.	.	.	.	.	6	6	3.3	311	.	.	.	.	0	0	0
212	130	608	146	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
213	126	1092	185	4	10	6	5.5	586	8	8	4.9	528	.	.	.	.	0	0	0
214	132	1075	169	.	.	.	.	.	6	6	3.2	315	.	.	.	.	0	0	0
215	130	756	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
216	130	667	197	4	9	7	3.5	308	7	7	3.1	262	9	6	3.3	316	0	0	0
217	133	721	169	.	.	.	.	.	6	6	2.6	233	.	.	.	.	0	0	0
218	142	250	219	9	6	3	1.0	106	4	3	1.1	91	4	3	1.1	101	0	0	0
219	130	820	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
220	130	996	268	3	9	8	3.6	601	8	7	3.7	536	11	11	3.9	662	8	0	0
222	142	809	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
223	134	777	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
224	133	907	212	6	9	7	2.8	389	6	6	2.6	328	8	6	2.7	390	0	0	0
225	132	810	177	3	7	7	3.2	442	6	6	3.0	416	.	.	.	.	0	0	0
226	127	1127	268	3	10	11	6.1	673	8	8	5.6	574	12	22	6.8	862	11	52	23
227	126	439	177	2	6	6	3.7	455	6	6	3.7	455	.	.	.	.	0	0	0
228	132	660	169	.	.	.	.	.	6	6	2.7	338	.	.	.	.	0	0	0
229	136	403	169	.	.	.	.	.	4	3	1.6	145	.	.	.	.	0	0	0
230	134	405	191	4	6	4	2.0	242	5	5	2.0	230	6	2	1.9	230	0	0	0
231	138	165 *	156	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
232	132	545	148	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
233	134	490	219	4	6	6	2.1	260	5	5	2.2	240	7	6	2.0	258	0	0	0
234	132	630	185	2	5	5	2.7	353	5	5	2.7	353	.	.	.	.	0	0	0
235	136	635	169	.	.	.	.	.	4	4	2.1	211	.	.	.	.	0	0	0
236	133	376	140	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
237	133	448	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
239	130	346	142	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
240	134	435	185	4	6	4	2.0	203	4	4	2.0	201	.	.	.	.	0	0	0
241	132	559	191	4	7	5	2.6	349	6	6	2.3	287	8	6	2.9	363	0	0	0
242	138	408	162	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
243	127	988	197	4	11	12	5.8	780	9	9	5.3	582	12	19	6.8	838	0	0	0
244	130	907	212	3	8	8	4.4	663	7	7	4.0	540	10	9	4.6	708	1	0	0
245	136	388	151	.	.	.	.	.	.	.	.	.	.	.	.	.	0	0	0
246	130	800	268	4	9	8	4.4	775	7	7	3.7	557	10	8	4.8	824	5	3	0
247	132	605	177	2	6	6	2.3	304	6	6	2.3	304	.	.	.	.	0	0	0
248	136	615	226	8	6	4	1.5	191	4	4	1.8	205	6	4	2.1	185	0	0	0
249	130	860	212	5	7	5	2.4	269	5	5	2.4	259	7	5	2.4	269	0	0	0
250	134	694	185	.	.	.	.	.	5	5	2.3	239	.	.	.	.	0	0	0

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida.

KEY

F1	Fertilizer treatment 0 = Half fertilizer (0.638 ± 0.021 g Jobe's 10-10-4 plant food spikes) on April 12. 1 = Full fertilizer (1.286 ± 0.028 g Jobe's 10-10-4 plant food spikes) on March 21.
F2	Seed families number 10 to 34 collected from separate maternal parents.
PL	Individual plant identification number 1 to 613. In order to maintain a balanced design an additional number was assigned to each plant (not shown) If measurements were missing on a plant this number was arbitrarily set equal to 1. The remaining plant were assigned a random number from a uniform distribution from 0 to 1. From the nine plants in each family, fertilizer treatment combination, the two with the highest number were excluded from the analyses. These are indicated by a asterix following the identification number.
DE	Date of establishment (the date the first true leaf was longer than 1.5 cm, where DE = 1 designates February 29, 1988).
CA	Cotyledon area on DE. The sum of the product of the maximum length and width of each cotyledon (mm squared).
DFFB	Date of first flower bud (again DFFB = 1 designates February 29, 1988).
N x L x SD x PH x	The number of nodes (N), number of leaves (L), stem diameter in mm (SD), and plant height in mm (PH), on date x. Where: x = 0 is the date a flower bud was first observed (DFFB). x = 1 is April 12 to 14 x = 2 is May 3 to 5.

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
0	1	53	5	759	49	11	7	3.3	103	9	5	3.1	84	13	13	4.3	180
0	1	352	9	1020	49	11	5	4.1	117	10	6	4.0	103	14	12	6.0	273
0	1	5	13	870	65	12	10	4.4	160	8	5	2.8	64	12	10	4.4	160
0	1	74	13	818	65	11	7	4.4	150	8	5	2.8	63	11	7	4.4	150
0	1	387	9	948	57	11	7	4.2	137	8	5	3.2	89	12	8	4.8	220
0	1	392	7	793	53	11	7	3.9	124	9	5	3.2	87	13	11	5.5	253
0	1	273	7	857	53	11	7	3.5	104	9	5	3.2	75	13	13	4.6	211
0	1	229 *	7	793	53	11	7	3.7	99	9	5	3.3	70	13	18	4.5	188
0	1	123 *	9	1410	57	12	8	5.0	203	9	5	3.6	97	13	12	6.1	318
1	1	598	21	540	45	9	7	4.0	108	9	7	4.0	115	13	12	5.4	225
1	1	451	13	805	53	12	8	5.7	168	11	9	5.1	144	14	12	6.1	253
1	1	186	13	388	45	10	8	4.2	95	10	8	4.0	90	14	11	5.6	188
1	1	489	7	782	53	13	22	6.8	213	11	13	5.5	150	15	34	7.9	368
1	1	520	9	918	53	13	21	6.7	233	11	12	5.9	175	15	36	7.6	394
1	1	602	9	864	57	13	8	5.7	158	11	9	5.0	130	14	11	6.0	240
1	1	370	15	698	57	13	14	6.1	198	11	9	5.1	145	15	16	6.4	287
1	1	217 *	7	1000	41	11	10	4.9	136	11	14	5.3	145	15	37	7.2	300
1	1	572 *	9	855	61	12	8	5.5	180	10	8	4.9	132	13	9	5.7	218
0	2	124	17	486	57	10	8	4.0	147	7	5	2.4	50	11	9	4.9	242
0	2	261	9	672	57	11	7	4.2	105	8	4	3.2	58	12	12	4.8	126
0	2	553	19	590	57	10	8	5.6	110	7	5	2.5	50	11	9	5.1	207

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
0	2	539	3	688	49	10	6	3.7	84	9	5	3.4	70	14	16	5.5	190
0	2	24	15	623	53	10	8	4.0	93	8	6	2.8	56	12	10	4.6	163
0	2	18	15	540	61	11	9	4.5	118	7	5	2.7	48	11	9	4.8	138
0	2	293	17	468	57	10	8	3.7	89	7	5	2.4	44	12	10	5.1	170
0	2	338 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	2	585 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	2	104	27	380	49	10	9	4.3	91	9	7	3.6	74	13	16	5.7	247
1	2	339	11	640	45	11	9	5.0	117	11	9	5.0	117	14	10	6 2	249
1	2	335	7	697	45	11	7	4.9	136	11	7	4.9	136	14	19	7.6	435
1	2	319	21	465	41	9	7	4.1	101	10	8	4.3	109	14	27	7 5	348
1	2	562	11	581	45	10	8	4.1	92	10	8	4.3	95	14	9	4 9	163
1	2	19	9	656	45	10	8	4.5	108	10	8	4.5	105	13	7	5.6	198
1	2	200	9	645	49	10	6	4.1	93	9	7	3.6	81	13	11	4.4	143
1	2	317 *	11	372	41	10	8	4.4	109	11	9	4.6	111	15	27	7.2	340
1	2	306 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	3	592	29	372	65	10	8	3.9	130	6	4	2.0	36	11	9	4.1	145
0	3	507	13	600	61	10	8	4.2	134	6	4	2.4	45	11	10	4.7	207
0	3	446	29	714	61	10	8	4.0	185	6	4	2.2	50	10	8	4.7	254
0	3	355	33	486	61	9	7	4.0	154	6	4	2 1	32	9	7	4.4	213
0	3	89	19	588	57	10	8	3.8	122	7	5	2 4	50	11	9	4.7	220
0	3	476	15	672	57	11	9	3.9	129	8	6	2 8	57	12	12	4 5	217
0	3	390	31	380	65	10	8	5.0	248	6	4	2 2	40	10	8	5 0	248
0	3	276 *	35	442	65	10	8	4.2	213	5	3	2.1	27	10	8	4 2	194
0	3	71 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	3	67	21	697	57	12	11	5.3	158	9	7	4 2	124	13	12	5 6	195
1	3	302	25	774	53	11	10	5.4	153	9	7	4 4	114	13	15	6 1	294
1	3	262	33	385	53	10	8	4.1	77	8	6	3 1	55	12	8	5 0	143
1	3	418	23	828	61	11	7	4.6	149	9	7	4.0	92	13	9	4.8	205
1	3	34	27	552	53	10	8	3.9	92	8	6	3 3	70	12	8	4 5	175
1	3	39	27	490	53	11	9	4.6	100	8	6	3 7	71	12	8	5 1	190
1	3	563	27	756	53	11	9	4.8	118	9	7	4.2	95	13	10	5 6	185
1	3	404 *	.	.	.	.	.		.			.	.	.	.		.
1	3	61 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	4	201	15	555	49	10	6	2.9	78	8	6	2 6	60	13	12	3 9	120
0	4	493	15	459	53	10	6	2.9	95	8	4	2 2	67	13	14	5 0	240
0	4	292	11	580	53	11	8	3 8	113	9	7	3 4	82	13	17	4 9	209
0	4	184	15	605	49	9	6	2.6	80	8	6	2.4	58	12	11	4.4	242
0	4	41	15	390	53	10	7	3 0	88	7	5	2.3	49	12	10	4 9	198
0	4	382	11	648	45	9	5	3.3	83	9	5	3 3	83	14	21	4 7	255
0	4	360	17	585	49	10	8	3 0	95	8	6	2 6	71	13	15	5 2	288
0	4	171 *	17	573	53	10	8	3 4	75	7	5	2 4	46	12	12	4 3	130
0	4	212 *	9	546	53	11	8	3.6	101	9	7	3 1	74	13	17	4.9	200
1	4	467	13	657	41	10	8	3 9	105	10	8	4.2	117	14	12	5 3	207
1	4	405	13	486	41	10	8	4.3	113	11	9	4 7	122	14	21	6 4	255
1	4	532	21	350	41	10	8	3.6	90	10	8	4.1	105	14	13	5.5	210
1	4	98	13	600	45	11	9	4.9	131	10	8	4 7	128	14	17	6 4	247
1	4	31	11	540	41	11	9	4.6	130	11	10	4 8	143	14	6	6 8	300
1	4	490	19	450	49	11	15	5.7	177	10	9	5.3	155	14	22	7.3	375

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	4	590	17	537	45	10	8	3.9	100	10	8	3.9	105	13	12	5.0	182
1	4	143 *	13	640	41	10	8	4.1	110	10	8	4.5	115	14	13	5.5	228
1	4	430 *	13	792	41	11	11	6.2	206	12	16	6.9	243	15	35	9.1	468
0	5	180	17	600	57	10	8	3.6	95	7	5	2.6	108	12	10	4.0	125
0	5	356	1	1229	49	11	6	3.8	103	10	5	3.6	86	13	15	4.7	213
0	5	38	35	297	61	9	7	4.0	88	6	4	1.8	22	10	8	4.4	117
0	5	26	9	532	49	10	7	2.8	70	8	6	2.5	52	13	13	3.9	150
0	5	528	5	690	49	11	7	3.1	99	10	6	3.1	89	13	14	4.1	186
0	5	9	9	798	53	11	7	4.0	96	8	4	3.3	66	12	11	4.4	153
0	5	43	19	391	49	9	7	2.6	60	7	5	2.2	48	10	12	4.0	185
0	5	289 *	13	504	53	10	6	3.4	89	8	4	2.8	60	12	12	4.9	323
0	5	65 *	1	800	49	10	6	3.6	96	9	5	3.4	81	12	12	4.6	205
1	5	63	9	945	49	12	16	6.4	155	11	11	6.3	137	14	26	7.2	250
1	5	444	3	1083	37	11	11	5.3	147	12	18	5.7	160	15	36	7.4	311
1	5	66	7	858	41	11	9	5.0	119	11	9	5.2	128	14	17	4.6	215
1	5	586	11	823	57	13	16	6.0	156	11	9	5.5	128	14	15	6.2	190
1	5	334	15	894	41	10	9	4.6	150	11	13	5.1	162	15	31	6.9	415
1	5	45	25	362	49	10	8	3.5	70	8	6	3.0	58	12	9	4.0	119
1	5	398	9	551	41	11	13	5.1	200	11	18	5.6	226	16	47	7.2	440
1	5	447 *	17	566	41	9	7	4.0	95	10	8	4.3	99	13	11	5.4	217
1	5	247 *	9	980	45	11	13	5.0	127	11	13	5.0	127	15	33	6.5	255
0	6	225	13	720	49	10	6	3.8	94	9	6	3.6	77	13	17	5.4	205
0	6	414	17	540	57	10	8	4.0	136	8	6	2.5	57	11	12	5.2	240
0	6	363	27	672	61	10	8	4.6	235	6	4	2.5	55	10	8	5.1	297
0	6	537	15	816	57	11	8	3.7	115	8	6	3.0	70	12	12	4.5	202
0	6	471	13	760	53	10	8	3.5	104	8	6	2.8	77	12	16	4.9	255
0	6	440	21	651	57	10	8	3.8	122	7	5	2.3	54	11	14	4.9	240
0	6	560	13	850	57	10	8	3.9	108	8	6	2.9	69	12	10	4.8	120
0	6	187 *	15	580	57	10	8	3.4	81	7	5	2.4	43	11	10	4.1	130
0	6	450 *		.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	6	309	23	776	61	11	7	4.3	210	8	6	3.5	102	12	8	4.5	262
1	6	554	21	864	53	12	20	5.9	181	10	12	5.0	143	15	31	7.0	293
1	6	91	13	729	37	10	8	4.0	103	11	9	4.9	137	13	16	6.0	305
1	6	278	27	360	49	11	13	4.3	106	9	7	3.7	83	14	33	6.6	272
1	6	148	13	833	45	10	8	3.7	110	10	8	3.8	108	13	13	4.8	258
1	6	555	19	610	45	10	8	4.7	115	10	8	4.7	118	14	15	5.9	210
1	6	206	17	690	53	11	7	4.4	123	10	8	3.7	95	13	17	5.6	194
1	6	454 *	19	675	53	11	9	5.7	170	10	8	5.0	146	13	12	6.2	280
1	6	551 *	13	1055	45	11	13	5.2	152	11	13	5.5	158	15	35	7.4	317
0	7	1	7	636	45	10	6	2.9	54	9	5	3.0	54	15	11	4.0	119
0	7	542	9	651	49	10	8	3.4	88	9	7	3.2	75	14	23	5.8	220
0	7	534	11	579	49	10	8	3.0	73	9	7	2.9	60	14	26	6.0	216
0	7	511	9	682	53	11	8	3.6	105	9	6	3.1	77	14	15	5.4	223
0	7	281	5	500	49	10	7	3.0	70	8	5	2.9	60	13	13	4.5	160
0	7	550	11	486	49	10	8	3.0	79	9	7	2.8	56	13	22	5.4	300
0	7	280	1	710	49	10	6	3.0	83	10	6	2.9	72	14	15	3.8	166
0	7	425 *	11	535	53	11	8	3.4	96	9	6	3.0	64	13	12	5.2	268
0	7	502 *	.	.	49	9	7	2.6	66	8	6	2.5	54	13	20	5.1	220

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key)

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	7	52	9	742	49	12	10	4.6	121	11	9	4.3	110	14	13	4.9	172
1	7	322	5	713	41	12	10	5.3	123	12	12	5.5	131	16	12	6.9	290
1	7	204	13	438	41	10	8	3.4	64	10	8	3.6	70	13	14	4.6	130
1	7	125	7	577	45	11	11	4.5	100	11	10	4.4	100	15	28	5.9	236
1	7	494	7	588	45	11	12	5.2	121	11	12	5.4	124	15	27	6.5	216
1	7	556	7	391	41	11	9	4.9	108	11	11	5.2	123	15	20	6.1	188
1	7	99	7	743	41	11	11	5.2	128	12	14	5.4	132	15	29	7.2	196
1	7	581 *	7	755	45	11	12	5.7	145	12	14	5.9	147	15	33	7.7	295
1	7	488 *	7	777	49	12	16	5.6	160	11	11	5.2	132	15	32	7.2	293
0	8	303	7	574	57	12	8	4.7	164	9	5	3.2	65	13	10	5.5	251
0	8	270	5	720	53	11	7	3.7	102	9	5	3.0	71	13	10	5.6	250
0	8	331	13	704	61	11	9	4.6	197	8	6	2.6	57	12	8	5.1	265
0	8	210	15	348	49	9	7	2.4	58	8	6	2.2	45	12	11	4.1	163
0	8	412	7	656	45	9	5	3.4	68	10	6	3.2	69	14	14	5.2	220
0	8	59	7	704	53	11	7	3.6	90	9	5	3.0	65	13	11	4.7	177
0	8	169	7	610	57	11	8	3.5	79	8	6	2.7	52	13	12	4.1	104
0	8	611 *	7	615	53	10	6	3.4	94	9	5	3.2	69	13	11	5.7	260
0	8	540 *	.	.	.	.	.	.	.	.	.		.	.	.	.	.
1	8	131	3	513	41	12	14	5.0	120	11	14	5.2	121	16	34	7.1	271
1	8	203	7	624	45	11	9	4.1	86	10	8	4.2	84	14	11	5.2	128
1	8	21	3	691	45	11	9	4.6	104	11	9	4.5	104	14	10	5.4	156
1	8	155	5	609	45	11	9	4.3	92	11	9	4.4	90	14	15	5.7	156
1	8	230	5	636	45	11	9	4.4	92	11	9	4.4	92	14	10	5.4	143
1	8	15	11	473	45	10	8	3.5	82	10	8	3.5	80	13	10	4.5	132
1	8	144	7	534	45	10	8	4.4	88	10	8	4.0	85	14	9	5.1	160
1	8	513 *	3	468	45	11	9	4.6	119	11	10	4.7	122	15	19	6.2	253
1	8	401 *	.	.		.	.	.	.	.	.	.	.	.	.	.	.
0	9	28	3	894	49	11	7	3.9	106	10	6	3.6	92	14	14	5.3	231
0	9	57	7	743	49	10	6	3.5	104	9	5	3.3	90	13	12	5.0	209
0	9	557	1	981	49	12	7	4.0	136	11	7	3.7	117	14	15	5.1	229
0	9	487	27	172	49	9	7	2.6	61	8	6	2.3	50	12	16	5.8	301
0	9	485	9	508	53	11	7	3.4	97	9	5	3.0	75	13	13	5.6	277
0	9	410	9	462	53	10	6	3.3	95	8	4	3.2	74	13	13	4.6	211
0	9	294	1	672	53	11	7	3.8	117	9	5	3.4	89	13	13	5.2	200
0	9	297 *	11	620	57	11	7	3.9	111	8	4	2.9	69	12	10	4.5	165
0	9	349 *	.	.		.	.		.				.		.		
1	9	32	1	720	41	11	11	5.5	144	11	15	5.5	158	15	23	6.6	304
1	9	268	3	450	41	11	9	5.0	129	11	9	5.1	140	14	11	6.0	240
1	9	301	7	595	45	12	14	5.7	166	12	14	5.7	166	15	32	7.5	343
1	9	8	5	551	45	11	9	5.2	140	11	9	5.1	138	14	12	5.9	225
1	9	420	7	866	57	14	13	6.0	191	12	10	5.4	155	15	16	6.2	255
1	9	55	3	664	41	10	8	4.9	114	11	9	5.5	125	14	11	6.2	214
1	9	305	5	925	49	13	17	5.6	144	12	11	4.7	115	16	38	7.5	317
1	9	133 *	9	312	37	10	8	4.0	107	11	13	5.3	158	15	32	6.5	314
1	9	477 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	10	277	9	858	57	12	8	5.1	94	9	5	3.4	70	13	12	6.0	232
0	10	535	11	455	57	12	8	4.7	117	9	5	3.0	61	13	12	5.6	150
0	10	518	13	468	57	11	9	3.8	115	8	6	2.5	56	12	13	5.4	270

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
0	10	164	9	752	53	11	7	3.8	86	9	5	3.1	60	13	12	4.9	130
0	10	146	7	952	45	10	6	3.9	99	10	6	3.9	95	14	15	5.6	227
0	10	157	5	518	49	10	6	3.5	78	9	5	3.1	65	13	12	4.7	127
0	10	165	7	834	49	11	7	3.6	78	9	5	3.3	64	13	9	5.1	132
0	10	379 *	11	602	53	11	7	3.3	90	9	5	3.0	67	13	12	5.4	235
0	10	599 *	11	677	57	12	8	4.3	125	9	5	2.9	77	13	11	5.3	203
1	10	299	1	850	41	11	9	5.7	131	12	10	6.1	139	15	15	7.0	247
1	10	603	9	420	49	12	10	5.8	149	11	9	5.5	137	14	15	6.3	220
1	10	269	9	630	41	11	9	5 6	150	12	10	5.8	157	15	23	6.8	277
1	10	367	11	720	45	12	9	5.9	195	12	9	5.9	195	16	33	8.9	464
1	10	20	11	656	45	10	8	4.6	108	10	8	4.5	109	13	13	5.3	188
1	10	219	5	962	41	11	9	5 5	127	12	10	5.8	134	15	14	6.5	200
1	10	134	15	682	41	10	8	5.5	128	11	9	5.3	135	14	23	8.3	310
1	10	291 *	11	546	45	11	12	5.2	139	11	12	5 2	139	15	41	8.4	306
1	10	461 *	9	677	53	13	17	5.7	209	12	14	6.5	168	15	23	8.2	314
0	11	285	13	975	53	11	8	3.5	95	9	7	3 1	69	13	11	4.4	135
0	11	344	15	748	49	9	7	3.0	85	8	6	2.7	70	12	14	4.9	227
0	11	82	13	855	49	10	7	3.5	84	9	7	3 2	70	13	13	4.7	156
0	11	340	11	672	53	11	9	3.9	125	9	7	3.0	88	13	17	5.0	244
0	11	609	19	1108	57	11	9	4 8	141	8	6	3.1	80	12	10	6 1	225
0	11	561	17	682	53	10	8	3.4	95	8	6	2 9	71	12	15	4.7	150
0	11	564	9	550	53	11	7	3 6	88	9	5	3.2	69	13	12	4 4	138
0	11	150 *	13	950	57	12	8	5.0	148	8	6	3.3	73	13	14	5.3	218
0	11	583 *	25	490	61	10	8	4.4	228	6	4	2.5	4 4	11	8	4.8	280
1	11	159	21	576	61	11	7	4.3	99	8	6	3 4	61	12	9	4.3	107
1	11	591	9	937	45	11	9	4.7	110	11	9	4.8	112	14	13	5.5	150
1	11	323	7	744	41	11	9	5.6	132	12	10	5.7	145	15	21	7.3	288
1	11	211	7	936	45	11	14	6 0	153	11	14	6.0	153	14	34	7.5	250
1	11	176	9	944	49	11	9	4.8	110	10	8	4.3	102	13	12	5.1	165
1	11	175	15	888	49	11	9	4.7	92	10	8	4 2	84	13	11	5.4	148
1	11	588	9	713	45	11	9	4.5	110	11	9	4.6	112	14	12	6.0	170
1	11	332 *	5	799	41	12	12	5 6	133	12	15	5.6	141	16	37	7.3	299
1	11	258 *	17	765	45	11	9	5.0	112	11	9	5 0	112	15	32	7.1	220
0	12	149	7	833	57	12	8	3.9	135	8	5	3 1	81	12	11	4.4	205
0	12	475	17	667	61	10	8	4.3	152	7	5	2 3	60	11	9	5.0	220
0	12	239	7	1082	57	11	7	4.5	162	8	4	3.5	75	12	11	5 3	243
0	12	127	5	858	41	9	7	3 1	70	9	5	3.2	73	13	11	4.6	203
0	12	312	11	675	53	10	8	3.3	101	8	6	2.5	66	12	10	5.1	265
0	12	347	9	1008	57	11	7	4.2	172	8	5	3.1	78	13	12	5.1	250
0	12	530	21	425	57	9	7	3.2	83	6	4	2.0	4 4	11	9	4.1	143
0	12	587 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
0	12	62 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	12	351	13	373	41	10	9	4.2	130	10	13	4 8	138	14	29	6.9	281
1	12	336	9	652	41	10	8	4.3	168	11	11	4.9	181	14	28	7.2	570
1	12	48	5	784	49	11	8	4.8	132	10	8	4.6	118	13	9	5.3	195
1	12	448	9	602	37	10	8	4.4	120	11	13	5.7	164	14	23	6.4	295
1	12	522	21	288	41	10	8	3.9	130	10	12	4.4	112	14	30	5.7	264
1	12	608	1	864	33	10	8	4.0	115	12	27	5 5	194	16	42	6.6	290

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	12	237	11	600	45	10	8	4.5	123	10	8	4.5	123	13	13	5.0	220
1	12	49 *	11	442	49	10	7	3.5	93	7	5	3.3	82	12	11	3.9	146
1	12	197 *	11	713	49	11	9	4.9	124	10	8	4.2	108	13	13	5.8	193
0	13	112	23	207	53	10	8	2.9	67	7	5	2.1	40	12	14	4.2	173
0	13	378	5	882	49	10	6	3.8	92	9	6	3.7	79	13	15	5.0	231
0	13	594	11	889	49	10	6	3.4	87	9	6	3.4	77	13	12	4.9	165
0	13	547	17	585	53	10	8	3.3	80	8	6	2.9	60	12	12	5.3	215
0	13	216	13	419	45	8	6	2.7	58	8	6	2.7	58	13	13	4.1	186
0	13	472	5	900	57	11	7	4.1	130	9	6	3.6	80	13	12	5.1	215
0	13	361	7	667	41	9	7	3.4	81	9	7	3.4	84	14	17	4.8	250
0	13	12 *	17	523	61	11	9	4.2	121	8	6	2.7	51	12	10	4.3	150
0	13	409 *	15	324	49	9	7	2.3	63	8	6	2.3	53	12	11	4.3	200
1	13	240	5	950	41	11	9	4.7	128	11	9	5.0	139	14	19	5.9	262
1	13	460	7	615	37	10	8	4.4	117	11	10	5.0	144	15	30	7 1	307
1	13	295	9	850	45	11	9	5.0	122	11	9	5.0	122	14	16	6.2	213
1	13	166	3	600	41	10	8	4.1	100	11	9	4.3	106	13	10	5.2	162
1	13	426	13	776	41	11	9	4.9	141	11	12	5.2	152	15	29	7.4	344
1	13	116	9	925	45	10	8	4.8	113	10	8	4.5	110	13	7	5.2	175
1	13	546	9	776	45	11	11	5.2	131	11	12	5.5	135	14	21	6.5	264
1	13	526 *	9	864	41	11	9	4.4	125	11	9	5 8	142	14	14	6.2	200
1	13	107 *	9	444	41	11	9	4.5	114	11	9	4.6	127	14	17	6.2	238
0	14	318	11	446	49	11	7	3.3	93	9	5	3.5	80	13	19	5.0	297
0	14	452	13	704	53	11	9	3.9	117	9	7	3.1	82	13	14	4 8	210
0	14	274	21	400	57	10	8	3.3	90	7	5	2 3	45	11	11	4.4	185
0	14	479	11	600	57	12	12	4.3	183	9	4	3 4	100	13	23	5.0	258
0	14	115	13	727	57	11	7	4.1	120	8	5	3 0	78	12	10	4.5	165
0	14	544	21	509	57	10	8	3.8	132	7	5	2.3	57	11	15	5 1	241
0	14	249	17	401	57	10	8	4 1	93	7	5	2.2	52	12	16	4.5	185
0	14	207 *	3	817	49	11	7	3.5	97	9	5	3 5	85	13	23	4.5	220
0	14	501 *	47	275		.		.	.	4	2	1.7	17	9	7	4 6	200
1	14	373	7	630	45	11	14	5.1	140	11	14	5 1	140	14	27	6.3	265
1	14	102	11	600	41	11	12	5.0	148	11	12	5.5	158	14	31	7 1	278
1	14	429	9	642	41	11	16	5.7	220	12	24	6.2	253	15	40	7.4	425
1	14	364	9	486	41	10	10	4.5	150	11	10	4 7	153	15	35	6 6	356
1	14	284	11	342	41	10	8	4.3	89	11	9	4 4	96	14	12	5 5	190
1	14	443	13	372	41	10	8	4.7	145	11	15	5 2	153	15	34	7.2	283
1	14	232	17	580	53	11	9	5 0	118	10	8	4 1	98	13	12	5 3	183
1	14	2 *	7	720	49	12	15	5 6	135	11	9	5.1	116	14	21	6 0	205
1	14	275 *	7	792	45	11	14	4.4	109	11	14	4.4	109	14	32	6 2	213
0	15	327	11	981	57	12	8	5.0	183	9	5	3.5	90	13	13	5 6	269
0	15	188	13	709	65	12	10	4.5	122	8	6	2 8	65	12	10	4.5	122
0	15	503	9	677	57	12	10	4.8	130	9	7	3.5	84	13	16	6 1	227
0	15	90	13	716	61	11	9	5.0	180	8	6	3 1	67	12	10	5 5	237
0	15	14	11	731	57	11	7	4.5	103	8	6	3.2	65	12	8	4 9	144
0	15	35	11	420	53	10	8	3.4	87	8	6	2 6	53	12	11	4 8	145
0	15	500	13	624	57	12	8	4.5	106	9	5	3.3	78	13	12	5.4	178
0	15	253 *	13	688	57	11	9	4.2	104	8	6	2 9	65	12	12	5 1	158
0	15	606 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	15	348	13	802	49	11	13	5.4	138	10	8	4.4	105	14	24	7.0	270
1	15	521	9	585	57	13	14	7.0	264	11	10	5.7	147	14	15	7.5	380
1	15	388	9	637	45	11	9	5.4	111	11	9	5.2	111	14	17	6.3	187
1	15	160	11	565	69	14	12	5.1	137	10	8	4.0	82	13	8	4.9	128
1	15	543	15	660	41	10	8	4.5	110	10	8	5.0	125	14	10	6.2	247
1	15	441	13	536	45	10	12	5.4	153	11	14	5.3	158	14	25	6.6	265
1	15	376	17	585	45	10	8	4.1	101	10	8	4.1	101	12	6	5.4	209
1	15	117 *	7	630	41	10	8	4.2	104	10	8	4.4	110	13	10	5.5	230
1	15	402 *	13	645	57	13	14	6.1	176	10	8	4.6	126	14	16	6.2	250
0	16	569	27	420	49	8	6	1.9	60	6	4	1.9	44	11	11	3.8	201
0	16	328	15	914	49	10	6	2.8	105	8	5	2.5	82	12	12	4.6	291
0	16	72	15	876	49	10	7	3.1	94	8	6	2.6	78	12	12	4.4	212
0	16	435	27	882	57	9	7	3.9	134	6	4	2.3	63	10	10	4.8	215
0	16	415	13	1265	45	9	4	3.1	94	9	5	3.2	95	13	16	4.5	263
0	16	517	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	16	377	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	16	445 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	16	46 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	16	389	21	1097	45	10	8	4.5	150	10	8	4.5	150	14	14	5.3	273
1	16	222	23	664	53	11	9	3.9	98	9	7	3.2	80	13	11	4.1	148
1	16	406	27	480	49	10	9	4.2	129	8	6	3.7	102	13	14	5.3	237
1	16	519	19	703	41	9	7	4.2	150	10	10	4.9	167	14	26	6.3	367
1	16	263	19	646	41	8	6	3.0	81	9	7	3.3	95	13	13	4.1	190
1	16	595	19	666	41	9	7	3 6	105	10	10	4.1	128	14	24	5.1	262
1	16	462	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	16	126 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	16	529 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	17	383	3	660	45	9	5	3.3	64	9	5	3 3	64	14	18	5.3	233
0	17	56	9	500	49	9	7	3.0	65	8	6	2.6	50	12	14	4.8	171
0	17	80	13	694	53	10	8	3.4	81	7	5	2.4	48	11	9	4.2	146
0	17	154	9	660	53	10	8	3.6	80	8	6	3.0	85	12	15	4.1	116
0	17	416	5	1083	45	10	6	4.2	90	11	7	4.2	93	15	18	5.5	235
0	17	108	9	1282	49	11	7	3 6	86	9	6	3.4	72	13	14	5.4	245
0	17	393	5	841	57	12	10	4.5	160	9	5	3.4	69	13	15	5.7	252
0	17	395 *	13	414	49	9	7	2 6	64	8	6	2.4	55	12	7	4.1	231
0	17	374 *	11	950	53	11	6	3.8	101	9	4	3.2	70	12	14	5.0	228
1	17	424	13	532	45	10	9	5.1	135	10	9	5.2	139	14	20	6.4	264
1	17	151	7	704	41	11	10	5 0	120	11	13	5.5	129	14	24	6.0	238
1	17	552	13	528	41	10	8	4.3	100	10	9	4.8	112	14	17	6.8	241
1	17	492	3	759	45	11	16	5.8	139	11	19	5.7	143	14	31	6 6	221
1	17	120	11	520	41	10	8	4.1	100	10	8	4.3	103	14	15	5.2	207
1	17	366	7	586	41	10	11	5.2	170	11	15	5.8	186	14	40	7.5	404
1	17	223	13	335	41	10	8	3.4	78	10	8	3.6	84	14	18	4.5	160
1	17	512 *	9	656	45	11	13	5.5	142	11	14	5.8	145	14	28	6.3	238
1	17	122 *	11	284	41	10	9	4.1	104	11	12	4.4	115	14	28	5.7	2725
0	18	130	31	200	45	6	4	1.9	29	6	4	1.8	29	11	9	4.2	200
0	18	600	21	312	45	8	6	2.2	50	8	6	2.2	52	12	12	4.1	210
0	18	403	17	429	49	9	7	2.6	64	8	6	2.6	46	12	12	4.7	237

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
0	18	385	21	656	57	10	8	4.0	156	7	5	2.8	62	11	9	4.7	248
0	18	129	15	771	57	10	8	3.8	129	7	5	2.5	60	11	9	3.9	145
0	18	135	11	823	57	11	9	4.2	184	8	6	3.0	75	12	9	4.8	243
0	18	515	15	416	57	11	9	3.9	117	8	6	2.6	55	12	12	4.9	210
0	18	419 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	18	255 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	18	68	15	375	45	10	8	4.2	119	10	8	4.0	113	14	11	5.4	187
1	18	78	31	364	61	11	8	4.8	135	8	6	3.3	67	12	8	4.9	188
1	18	433	19	479	45	10	8	4.3	110	10	8	4.2	114	14	16	5.7	267
1	18	109	15	384	41	10	8	3.8	86	10	8	4.1	98	14	19	5.4	240
1	18	400	25	377	45	9	7	3.6	79	9	7	3.6	79	12	8	4.5	178
1	18	300	7	1036	41	11	9	5.5	160	12	15	5 8	165	15	29	7.4	342
1	18	612	15	390	37	9	7	3.2	86	11	9	4.3	111	14	14	6.0	275
1	18	177 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	18	121 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	19	525	5	600	57	11	7	4.2	109	9	5	3 0	70	13	11	5.3	155
0	19	101	9	784	57	11	8	4.0	120	8	6	3.0	67	12	11	5.1	180
0	19	283	15	833	61	11	9	4 0	112	7	5	2 4	58	12	9	4.4	142
0	19	147	1	760	61	13	10	4 8	152	10	6	3.4	93	13	11	5 1	173
0	19	30	11	660	57	11	8	4 3	118	8	6	3.4	72	12	9	5.0	217
0	19	218	3	540	49	10	6	3 1	75	9	5	3.0	65	13	13	4.1	160
0	19	69	17	630	61	10	8	3 9	114	7	5	2.5	55	11	8	4.2	145
0	19	170 *	19	637	61	11	9	4.1	105	7	5	2.7	60	11	9	4.2	113
0	19	315 *	13	874	57	11	9	4.3	163	8	6	2 9	70	12	10	5.7	271
1	19	88	19	754	57	11	7	4 9	122	9	7	4.0	97	11	7	5.1	160
1	19	16	7	952	45	12	10	5.6	132	11	9	5.5	131	14	12	6.7	212
1	19	168	31	799	69	13	9	5.9	148	8	6	3.7	67	12	8	5.5	127
1	19	234	7	600	45	10	8	4.0	94	10	8	4.0	94	13	7	5.1	132
1	19	480	13	1218	57	12	9	6.0	157	11	9	5 1	124	14	11	6 3	200
1	19	4 4	19	1075	57	12	8	5.5	130	10	8	4.4	104	13	8	5.3	168
1	19	313	7	600	45	12	14	5.4	147	12	14	5.4	147	16	31	7.3	320
1	19	330 *	3	750	53	13	14	6.9	175	12	10	5.5	142	15	22	7.5	288
1	19	85 *	35	1020	.	.	.	.	.	6	4	2.8	55	10	8	4.3	130
0	20	396	17	468	57	10	8	3.2	158	8	6	2.3	74	11	9	3 9	255
0	20	468	13	698	61	11	9	4.0	150	8	6	2 6	75	12	13	4 7	208
0	20	259	13	833	57	11	7	3.5	127	8	5	2 7	75	12	12	4.5	205
0	20	380	17	406	53	9	7	2 6	91	8	6	2 4	57	12	14	5 7	220
0	20	576	21	507	49	8	6	2 3	74	8	6	2 4	62	12	15	4.3	218
0	20	163	15	585	53	10	8	3 0	85	8	6	2.2	60	12	16	4 0	145
0	20	506	11	541	57	11	8	3 8	126	8	6	2 9	77	12	13	4 8	200
0	20	152 *	19	439	53	9	7	2 7	103	7	5	2.1	60	11	12	4 5	270
0	20	345 *	11	500	53	10	6	3 0	95	8	5	2.6	65	12	12	4 7	220
1	20	110	23	322	53	11	14	4 1	133	9	7	3.2	99	12	17	4 6	210
1	20	189	11	776	61	12	12	5 1	165	10	8	4.3	118	13	15	5 2	180
1	20	439	13	400	41	9	7	4.0	118	10	14	4.6	139	13	31	6.0	247
1	20	510	19	594	57	12	13	4.4	158	10	8	3.9	122	13	15	4.7	212
1	20	4 2	15	651	41	10	8	4.0	110	10	8	4.3	119	13	22	5.0	223
1	20	87	13	391	57	11	9	4.0	150	9	7	4.5	111	12	10	4.1	185

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	20	51	11	399	45	10	8	3.3	110	10	8	3.3	108	13	10	3.8	160
1	20	199 *	13	513	57	11	9	4.0	138	10	8	3.4	103	13	12	4.2	155
1	20	482 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	21	178	13	833	53	10	8	3.3	93	8	6	2.7	60	13	14	4.6	183
0	21	568	3	1040	49	12	8	3.9	106	11	7	4.8	94	15	20	5.0	223
0	21	570	11	1255	53	11	7	3.6	104	9	6	3.4	78	14	14	4.8	225
0	21	427	13	926	61	11	9	4.7	268	8	6	2.8	71	12	10	5.5	345
0	21	381	19	1134	53	10	8	3.6	100	8	6	3.1	67	13	12	5.4	247
0	21	193	7	995	49	11	7	3.6	89	10	8	3.3	74	14	15	5.1	178
0	21	559	17	1020	53	10	8	3.2	90	8	6	2.8	69	12	11	4.2	155
0	21	40 *	5	1205	57	12	8	4.8	158	10	7	4.1	100	12	12	5.3	208
0	21	94 *	13	480	49	10	6	2.7	85	8	6	2.5	66	13	12	4.7	252
1	21	357	13	894	45	11	9	4.5	114	11	9	4.5	114	15	15	6.2	258
1	21	359	9	676	41	11	9	5.0	146	12	15	5.3	154	16	26	6.8	320
1	21	238	13	1155	45	11	9	5.5	149	11	9	5.5	149	15	23	7.1	280
1	21	354	13	693	41	11	9	4.8	127	12	10	5.2	139	15	13	6.7	286
1	21	567	5	1061	45	12	13	5.8	154	12	15	6.1	156	16	27	7.0	270
1	21	92	9	1040	41	11	9	5.6	151	12	12	5.6	161	16	24	7.3	344
1	21	37	7	1060	41	11	9	5.2	149	12	12	5.6	158	16	24	6.6	260
1	21	50 *	21	920	57	13	9	4.6	113	10	8	4.0	86	13	11	4.8	144
1	21	60 *	7	1276	37	11	9	5.3	140	12	14	6.1	177	16	30	7.6	322
0	22	106	15	585	57	10	8	3.9	114	7	5	2.5	54	12	13	5.1	221
0	22	242	15	698	53	10	8	2.9	84	8	6	2.3	53	12	13	3.7	237
0	22	457	13	788	57	12	10	4.5	226	9	7	3.1	102	13	13	5.6	344
0	22	235	15	630	49	10	8	2.9	78	9	7	2.6	65	13	14	4.1	161
0	22	250	11	970	49	11	8	3.1	94	9	5	3.0	80	13	17	4.3	190
0	22	311	7	1060	53	12	8	3.7	114	10	8	3.2	84	14	13	5.1	247
0	22	538	9	742	49	10	6	2.8	83	9	5	2.7	69	13	12	4.6	210
0	22	308 *	1	810	57	12	8	4.6	183	10	6	3.3	80	13	13	5.3	277
0	22	195 *	11	656	57	11	7	3.5	104	8	5	2.6	64	13	14	4.2	147
1	22	453	13	600	41	10	8	4.1	115	11	10	4.7	131	14	18	6.1	265
1	22	257	9	600	57	13	11	5.6	152	11	9	4.9	127	15	14	5.9	281
1	22	324	3	580	41	11	9	4.4	120	12	10	4.1	126	15	18	5.2	253
1	22	428	11	645	49	12	16	5.3	192	12	16	5.0	173	15	24	6.9	416
1	22	198	27	704	57	12	11	5.1	140	9	7	3.7	88	13	16	5.7	181
1	22	233	11	372	41	11	9	3.8	89	11	9	3.8	100	15	18	5.0	191
1	22	136	11	468	49	12	17	6.1	134	10	8	5.2	117	14	22	7.1	273
1	22	571 *	9	996	45	11	9	4.4	115	11	9	4.6	119	14	16	5.7	217
1	22	248 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	23	610	13	600	57	11	8	4.0	142	8	6	2.8	65	12	11	4.9	215
0	23	455	31	558	65	11	9	5.2	261	6	4	2.2	60	11	10	5.4	264
0	23	484	13	473	57	11	7	3.9	138	8	6	2.6	60	12	10	5.1	259
0	23	329	13	507	53	10	8	3.0	104	8	6	2.3	61	12	11	5.0	273
0	23	325	13	426	53	10	7	3.2	103	8	6	2.5	62	12	10	4.5	224
0	23	548	27	855	73	11	13	5.5	291	6	4	2.4	60	10	13	5.0	245
0	23	431	11	700	49	10	7	3.0	76	8	6	3.0	59	12	10	5.1	297
0	23	362 *	41	405	.	.	.		.	4	2	1.7	33	9	7	4.6	267
0	23	346 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	23	505	17	509	41	10	8	4.4	103	11	13	4.8	120	15	23	6.7	200
1	23	214	21	629	41	9	7	4.3	92	10	8	4.6	105	14	23	7.2	225
1	23	142	21	451	57	12	8	4.6	114	9	7	3.6	87	13	8	5.2	150
1	23	343	7	540	37	10	8	3.8	96	11	10	4.8	120	15	18	6.5	224
1	23	565	19	495	57	13	13	5.3	122	10	8	4.2	100	14	16	5.9	145
1	23	96	11	1113	61	14	13	5.7	155	11	9	4.7	128	14	14	5.7	162
1	23	463	7	589	45	11	10	4.7	135	12	13	5.0	127	14	21	6.3	220
1	23	196 *	17	1004	65	14	9	5.4	158	10	8	4.0	110	14	9	5.4	158
1	23	119 *	17	792	45	10	8	4.1	115	10	8	4.0	110	13	8	5.5	215
0	24	70	7	514	53	11	8	3.5	108	9	5	3.1	77	13	16	4.6	177
0	24	153	5	676	49	10	6	3.3	90	9	5	3.3	75	13	9	5.3	297
0	24	465	11	615	53	11	9	3.8	111	9	7	3.2	86	13	16	5.1	182
0	24	593	3	809	57	12	11	4.6	134	10	6	3.6	94	14	12	5.1	156
0	24	436	7	776	57	11	10	4.5	133	9	5	3.3	79	13	13	5.0	200
0	24	29	7	656	49	10	6	3.2	100	9	5	3.0	87	13	14	5.1	213
0	24	179	7	1053	57	11	7	4.0	110	8	4	3.1	55	12	10	4.8	146
0	24	464 *	7	1204	57	12	11	4.7	166	10	6	3.7	109	14	19	5.3	212
0	24	191 *	15	544	57	10	8	3.8	104	8	6	2.5	55	12	14	4.3	142
1	24	307	7	765	45	11	9	5.0	135	11	9	5.0	135	12	11	5.8	298
1	24	114	7	1248	45	11	9	5.0	133	11	9	4.8	131	14	13	5.4	194
1	24	33	9	445	74	15	18	5.5	194	10	8	4.1	114	13	10	5.1	172
1	24	314	5	1394	45	12	12	5.5	156	12	12	5.5	156	15	24	7.0	276
1	24	6	7	590	49	11	9	4.6	113	10	8	4.2	102	13	13	6.1	170
1	24	97	13	795	69	14	14	5.5	244	10	8	4.5	118	13	10	5.3	225
1	24	369	3	990	45	12	11	5.6	144	12	11	5.6	144	14	17	6.5	283
1	24	601 *	3	857	49	12	12	5.4	150	11	10	5.4	140	14	18	6.1	235
1	24	93 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	25	243	11	615	53	10	6	2.7	75	8	5	2.3	52	12	12	4.1	280
0	25	527	5	752	49	11	8	3.6	93	9	6	3.4	80	13	17	4.7	177
0	25	113	13	351	41	8	6	2.3	54	8	6	2.5	55	13	17	4.1	208
0	25	224	19	525	49	9	7	3.5	65	7	5	2.1	50	12	14	3.9	150
0	25	221	7	552	49	11	7	3.3	84	10	6	3.1	69	14	21	4.1	140
0	25	358	9	416	41	8	6	2.5	68	9	7	2.8	70	14	19	4.5	256
0	25	582	11	630	53	11	7	3.1	100	9	5	2.8	68	13	11	4.6	280
0	25	11 *	11	479	49	10	8	2.8	78	8	6	2.4	50	13	17	4.2	191
0	25	545 *	9	580	41	9	7	3.5	78	10	6	3.5	84	15	22	4.9	220
1	25	577	11	611	41	10	8	4.6	130	11	15	5.1	152	14	32	6.0	250
1	25	407	7	683	41	11	12	4.9	145	11	16	5.3	154	15	31	6.5	265
1	25	205	9	912	41	11	9	4.9	115	11	9	4.8	126	15	17	5.4	197
1	25	386	9	925	45	12	14	5.5	154	12	14	5.5	154	15	23	6.1	250
1	25	432	9	776	37	11	9	4.9	122	12	19	5.7	161	15	40	6.9	274
1	25	286	5	816	37	10	8	5.4	143	11	15	5.3	138	15	35	6.8	245
1	25	605	13	446	41	10	8	4.6	120	11	13	4.8	138	15	29	5.8	250
1	25	495 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	25	375 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	26	246	1	631	41	9	5	3.1	84	9	5	3.2	87	13	13	4.5	206
0	26	533	3	616	49	11	7	3.9	107	10	6	3.6	106	13	18	5.3	202
0	26	496	7	300	49	10	6	2.8	83	9	5	2.7	72	13	17	4.3	168

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
0	26	10	5	311	41	9	5	2.8	70	9	5	2.9	70	13	17	4.5	193
0	26	391	13	374	41	8	6	2.5	64	8	6	2.6	69	13	15	4.8	228
0	26	607	11	546	53	10	7	3.2	94	8	5	2.9	71	12	14	4.7	180
0	26	498	3	432	49	10	6	3.0	80	9	5	2.7	71	13	15	4.7	177
0	26	36 *	9	582	49	10	6	3.4	101	8	5	3.2	81	12	12	4.7	180
0	26	304 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	26	437	1	350	45	12	13	4.8	130	11	13	4.8	137	15	29	6.2	255
1	26	128	3	500	41	11	9	5.3	130	11	10	5.2	140	15	20	6.4	277
1	26	337	11	846	41	10	8	5.1	155	11	14	5.8	179	15	35	8.0	545
1	26	236	5	352	37	10	8	3.6	86	11	9	4.2	112	14	20	5.4	210
1	26	254	7	736	41	10	8	5.0	125	11	10	5.2	134	14	17	6.4	225
1	26	17	3	527	37	10	8	3.8	97	10	8	4.3	115	14	16	5.3	210
1	26	287	9	784	45	11	18	6.6	182	11	18	6.6	182	15	40	8.1	328
1	26	245 *		.		.	.	.	.	.	.	.	.	.	.	.	.
1	26	156 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	27	279	15	620	53	10	7	3.1	84	7	4	2.5	54	11	10	4.3	174
0	27	514	13	500	57	11	9	3.6	115	8	6	2.5	63	12	10	4.8	240
0	27	597	11	342	53	10	7	3.1	82	8	6	2.7	65	13	11	4.0	148
0	27	523	33	500	61	9	7	3.8	115	6	4	2.0	48	10	8	4.2	125
0	27	417	37	420	77	11	9	4.9	221	6	4	1.9	41	10	8	4.5	197
0	27	320	11	513	57	11	9	4.9	198	8	5	2.9	80	12	9	5.6	318
0	27	499	5	510	57	11	7	4.0	105	9	5	3.0	72	12	11	4.4	123
0	27	579 *	23	1002	65	11	9	5.3	227	6	4	2.5	65	11	9	5.3	240
0	27	566 *	47	153	61	8	6	2.8	68	4	2	1.5	21	9	7	3.5	130
1	27	77	19	931	57	12	12	5.5	144	10	8	4 7	114	13	13	5.7	189
1	27	456	13	602	41	11	9	4.7	130	11	10	5.2	147	15	18	6.6	309
1	27	394	11	689	53	13	28	6.6	205	11	12	5.5	163	15	37	7.7	317
1	27	161	9	555	45	11	9	4.8	111	11	9	4.8	106	13	10	5.8	145
1	27	226	11	731	49	11	9	4.9	129	11	9	4.4	114	14	14	5 3	187
1	27	466	13	416	49	10	6	4.1	98	10	8	3.8	91	13	8	4.5	160
1	27	470	9	384	45	11	9	4.3	115	11	10	4.5	120	15	22	5.9	240
1	27	167 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	27	79 *	33	1054		.	.	.	.	7	5	3.5	78	12	8	5.1	192
0	28	185	11	875	61	11	9	4.6	117	8	6	3.1	60	12	10	4.7	130
0	28	54	9	615	61	11	7	4 3	126	8	6	3.0	76	12	8	4 6	138
0	28	473	7	442	57	11	7	4.2	134	8	4	3.0	77	12	8	5.3	202
0	28	504	7	553	61	11	8	4.4	144	8	6	2.7	74	12	9	5.0	185
0	28	172	11	532	61	11	7	4.2	107	7	5	3 0	61	12	8	4.5	116
0	28	105	9	600	65	12	9	5.2	193	8	6	3.0	68	12	9	5.2	193
0	28	260	7	594	61	11	8	4.4	148	8	6	3.0	65	11	8	4.6	162
0	28	413 *	15	551	57	10	8	3.8	133	6	4	2.5	65	11	9	4.9	245
0	28	86 *	13	481	57	10	8	4.1	113	7	5	2.7	60	11	9	4.8	162
1	28	326	13	600	57	12	8	5.0	153	10	8	4.2	115	13	8	5.3	222
1	28	509	9	682	57	13	9	6.0	144	11	9	5.1	120	14	10	6.4	181
1	28	578	13	693	53	10	11	5.7	167	9	7	4.9	145	12	16	6.3	230
1	28	215	7	784	45	11	13	4.2	133	11	13	4.2	133	15	25	5.7	286
1	28	536	7	704	53	12	9	6.0	154	11	9	5.5	140	14	10	6.3	203
1	28	368	13	442	53	12	16	6.4	227	10	9	5.2	176	14	25	7.8	395

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key)

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	28	541	9	481	57	12	8	5.4	141	10	8	4.6	114	13	7	5.4	174
1	28	397 *	13	524	53	13	16	6.4	214	11	9	5.5	154	15	20	7.8	397
1	28	23 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	29	474	7	450	53	11	7	3.0	95	9	5	2.7	76	14	21	4.3	226
0	29	524	13	372	53	10	8	2.7	85	8	6	2.3	63	12	15	4.1	175
0	29	434	7	574	49	10	6	3.1	83	9	5	3.0	70	14	19	4.6	223
0	29	296	13	580	53	10	7	3.0	79	8	5	2.3	50	13	13	3.6	157
0	29	213	13	345	49	9	7	2.3	61	8	6	2.1	46	12	14	4.3	200
0	29	58	13	486	53	11	7	3.4	105	8	6	2.6	75	13	16	4.5	212
0	29	411	13	368	45	8	6	2.3	53	8	6	2.4	55	13	16	4.0	230
0	29	384 *	9	546	49	10	6	3.1	98	9	5	2.9	74	13	17	4.8	250
0	29	190 *	9	384	45	9	5	2.5	54	9	6	2.3	55	14	17	3.8	165
1	29	173	11	683	45	11	9	3.9	97	10	8	3.7	96	14	14	4.5	156
1	29	209	13	594	41	10	8	4.2	101	11	13	4.6	111	15	33	6.0	247
1	29	298	15	442	45	10	8	3.9	88	10	8	3.9	88	14	18	5.1	240
1	29	27	7	834	37	11	9	4.1	108	11	9	4.6	123	15	17	5.0	205
1	29	574	7	526	45	11	13	5.6	150	11	15	5.4	152	15	35	6.3	257
1	29	423	13	481	37	10	8	4.1	119	11	13	4.9	159	15	27	5.9	258
1	29	231	11	387	45	11	9	3.6	98	11	9	3.6	98	14	18	4.6	181
1	29	244 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
1	29	194 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	30	372	11	828	57	11	7	4.5	148	9	7	3.1	75	13	12	5.4	235
0	30	321	33	640	57	10	8	4.1	189	6	4	2.2	49	11	9	5.1	305
0	30	282	19	311	53	10	7	2.6	78	8	6	2.2	60	12	9	3.8	145
0	30	491	13	907	53	11	9	3.7	97	9	7	3.3	64	13	15	5.3	240
0	30	438	17	683	57	10	8	4.4	134	8	6	2.7	65	12	10	5.2	220
0	30	478	9	851	57	12	8	4.6	149	10	6	3.3	90	14	16	5.0	230
0	30	508	5	570	57	11	7	3.3	104	9	6	2.6	57	15	14	4.2	170
0	30	47 *	17	726	57	10	8	4.0	114	7	5	2.8	64	12	10	5.0	180
0	30	174 *	19	817	61	11	9	3.9	95	7	5	2.6	52	11	9	4.3	110
1	30	399	9	640	41	11	10	5.8	190	11	13	6.0	207	15	27	7.8	430
1	30	137	9	782	41	11	12	5.0	137	11	13	5.3	148	15	33	6.7	321
1	30	516	19	720	49	11	9	4.9	123	10	8	4.5	113	13	13	5.7	233
1	30	227	17	878	53	11	13	5.3	149	10	8	4.5	132	14	17	5.7	220
1	30	288	31	1410	57	11	9	5.9	170	8	6	4.4	117	12	9	6.4	240
1	30	371	11	638	57	12	11	5.6	182	10	8	4.6	138	13	13	5.9	277
1	30	365	9	1020	41	10	8	4.8	145	11	9	4.7	156	15	31	6.7	360
1	30	140 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	30	158 *	41	801	.	.	.	.	.	4	2	2.2	19	9	7	3.3	90
0	31	573	13	800	57	11	7	3.7	123	8	4	2.9	66	12	8	4.3	178
0	31	549	17	574	53	10	6	2.7	77	8	4	2.3	54	12	9	5.2	264
0	31	310	17	784	69	12	9	5.8	305	7	5	2.7	65	11	7	5.6	265
0	31	183	21	756	65	11	9	5.3	234	7	5	2.5	48	11	9	5.3	234
0	31	589	23	513	65	11	9	4.1	145	7	5	2.3	44	11	9	4.3	163
0	31	596	13	1093	69	12	6	4.4	180	8	4	2.9	79	11	7	4.1	170
0	31	75	23	651	65	10	8	4.7	182	6	4	2.2	44	10	8	4.7	182
0	31	333 *	17	818	61	10	8	4.3	256	7	5	2.7	68	11	9	4.8	330
0	31	111 *	15	867	61	11	7	3.7	121	8	5	2.7	60	11	7	4.0	155

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
1	31	350	15	652	53	12	19	5.6	160	10	8	4.4	115	14	33	7.0	298
1	31	83	11	675	49	11	8	4.3	104	10	8	4.1	95	13	8	4.8	152
1	31	267	7	833	61	13	8	5.5	140	10	8	4.8	108	13	8	5.5	162
1	31	422	11	833	53	12	13	5.9	179	11	10	5.2	154	15	19	6.3	273
1	31	182	17	841	53	12	14	5.6	158	10	8	4.5	117	14	19	6.1	248
1	31	483	13	981	45	11	13	4.7	129	11	14	4.9	127	15	26	6.0	260
1	31	272	9	645	53	13	22	61	178	11	13	5.2	139	15	30	7.0	262
1	31	25 *	15	744	61	12	7	4.9	129	10	8	4.4	90	12	6	4.8	144
1	31	145 *	33	893	.	.	.	.	.	7	5	3 1	60	11	7	5.4	188
0	32	81	13	416	49	10	6	2.8	77	8	6	2.5	65	12	11	4.0	136
0	32	228	13	565	49	10	6	2.9	85	8	4	2.7	71	13	12	4.6	180
0	32	251	15	555	49	10	7	3.8	82	8	6	2.5	70	13	14	5.1	168
0	32	256	17	492	53	10	8	3.1	83	7	5	2.3	51	12	14	4.6	265
0	32	3	13	566	49	9	6	3.1	77	8	6	2.7	60	13	13	4.7	176
0	32	220	19	546	53	10	8	3.1	98	8	6	2.4	66	12	13	4.6	158
0	32	22	17	455	53	10	8	3.3	88	7	5	2.4	57	12	11	4.6	172
0	32	290 *	13	580	53	10	7	4.6	105	8	6	2.9	63	13	14	5.7	253
0	32	162 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	32	421	17	532	37	10	8	3.9	101	11	11	5 4	157	14	19	7.3	297
1	32	208	15	481	41	10	8	4.4	113	11	9	4.9	124	14	21	6.7	257
1	32	95	15	428	41	10	8	4.1	98	10	8	4.1	106	14	16	5.3	251
1	32	449	13	506	37	10	8	4.0	105	11	10	5.3	144	14	19	6 7	275
1	32	264	13	546	37	10	8	3.9	84	10	8	4.4	108	14	16	6.0	212
1	32	181	15	433	41	10	8	4 5	99	10	8	4.7	110	14	21	6.9	245
1	32	202	13	565	45	10	8	4.1	104	10	8	4.1	105	13	12	5.1	178
1	32	442 *	13	555	41	11	9	5.0	145	11	15	6.0	163	15	35	8.6	325
1	32	13 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	33	265	19	348	57	10	7	3.5	91	8	6	2.4	53	12	10	4.2	135
0	33	84	11	830	49	11	7	3.5	107	9	5	3.2	95	14	14	4.8	194
0	33	469	11	581	49	10	6	3.2	85	8	4	3.0	75	13	12	5.0	209
0	33	341	11	615	53	11	7	3.6	107	9	5	3.2	83	13	11	5.7	230
0	33	486	13	743	57	11	7	3.6	119	8	4	2.7	72	12	11	4.9	241
0	33	575	13	620	57	11	7	3.8	125	8	4	2.6	71	12	8	4.7	220
0	33	458	23	605	57	10	8	4.1	212	7	5	2.5	64	11	9	5.3	363
0	33	139 *	15	640	57	11	9	4.9	159	8	6	3.2	70	13	13	5.6	254
0	33	73 *	17	508	53	10	8	3.6	95	8	6	2.7	66	12	13	5 2	210
1	33	316	11	752	53	13	21	6.[illegible]	183	11	10	5.2	138	15	34	7.7	338
1	33	241	13	748	45	11	9	5.5	148	11	9	5.5	148	14	28	6.8	256
1	33	353	13	609	53	13	16	6.3	178	11	12	5.6	152	15	21	6.8	268
1	33	103	13	585	49	12	17	5.9	178	10	8	5.1	148	15	31	7.1	288
1	33	459	19	504	49	12	19	6.2	220	11	14	5.6	198	15	37	7.8	417
1	33	408	13	766	53	12	16	6.1	183	11	10	5.4	153	14	18	6.6	240
1	33	604	13	1197	57	13	14	6.4	177	11	9	5.4	140	14	14	6.9	235
1	33	584 *	21	522	49	11	10	4.4	110	10	8	4.2	100	14	22	5.4	200
1	33	64 *	19	523	57	12	8	4.4	119	9	7	3.8	87	13	10	7.0	160
0	34	138	1	1270	49	11	7	3.9	106	9	5	3.7	88	14	12	5.2	221
0	34	192	19	286	49	9	7	2.9	65	8	6	2.3	52	12	13	4.0	151
0	34	132	15	390	53	10	8	3.1	86	7	5	2.2	50	12	10	4.4	190

APPENDIX 5. Data for estimation of heritabilities of characters in Impatiens pallida continued (see page 63 for key).

F1	F2	PL	DE	CA	DFFB	N0	L0	SD0	PH0	N1	L1	SD1	PH1	N2	L2	SD2	PH2
0	34	558	3	736	45	9	6	3.0	73	9	5	3.0	77	13	12	4.3	181
0	34	100	11	540	57	10	8	4.3	130	8	6	3.0	56	13	11	4.8	195
0	34	76	7	406	45	9	6	2.4	50	8	6	2.5	51	13	11	4.2	188
0	34	531	9	611	53	11	9	3.5	92	8	6	3.1	69	13	15	4.4	168
0	34	342 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
0	34	266 *	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1	34	118	3	955	41	11	9	5.0	125	11	9	5.2	130	15	13	5.7	237
1	34	141	7	716	41	11	9	5.1	117	11	9	5.3	120	15	22	6.4	228
1	34	580	3	1113	45	12	12	5.1	145	12	13	5.1	150	15	[illegible]	6 1	285
1	34	4	5	1188	57	13	10	5.8	143	11	9	5.2	118	14	11	6 1	173
1	34	7	7	735	41	11	9	5.1	129	11	9	5.5	125	14	17	6.2	160
1	34	481	1	1045	45	12	10	5.7	151	12	10	5.7	149	15	16	6.4	266
1	34	271	7	592	49	12	16	6.1	182	11	10	5.6	158	15	23	7.0	265
1	34	252 *	7	1147	45	12	10	5.5	125	12	10	5.5	125	15	13	6.4	175
1	34	497 *	3	775	45	11	9	4.3	105	11	9	4 3	107	14	12	5.0	175