

CHAPTER 2

A seven-year study of individual variation in fruit production in tropical

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Keywords: *drift; diuraceae; seed dispersal; frugivory; tropics; mangung; phenology; plant reproduction; annual variation in fruit production*

Abstract. Fruit size varied from year to year

Introduction

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Study area

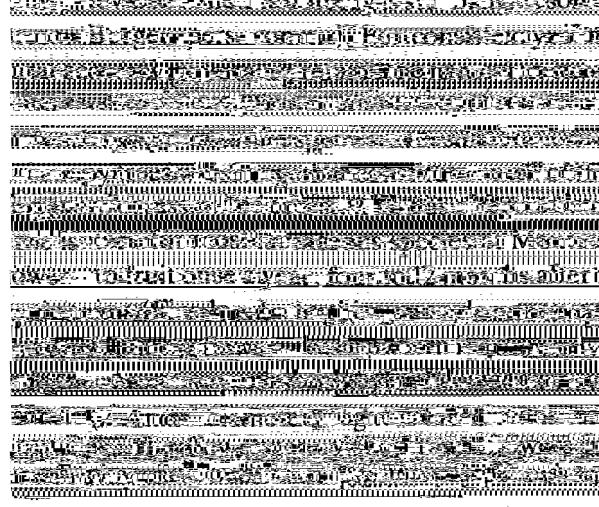
The study area covers 15 km² of lower montane wet and rain forests (Holdridge, 1967) in Monteverde, Costa Rica (10° N, 84° W).

Itself, 4 km to the east of the cloud forest on the divide



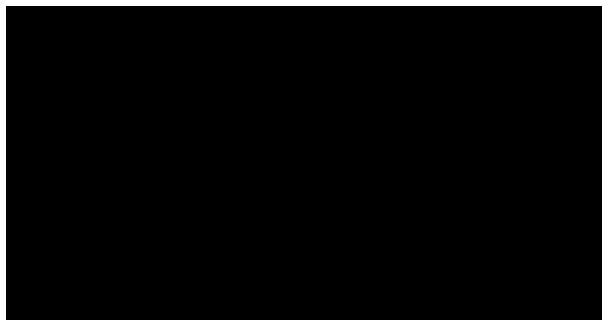
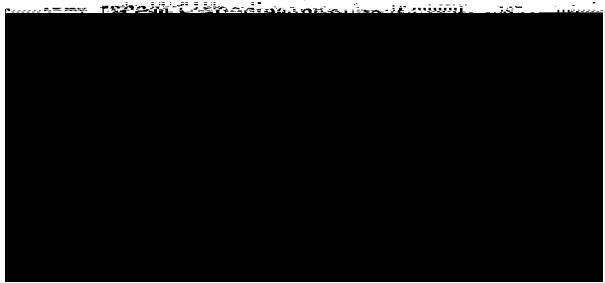
Species list

At least 22 bird-dispersed lauraceous tree species occur in the same or adjoining habitats at Monteverde. Their status is still being resolved (W.





wasps. In any month of the year, at least one lau-



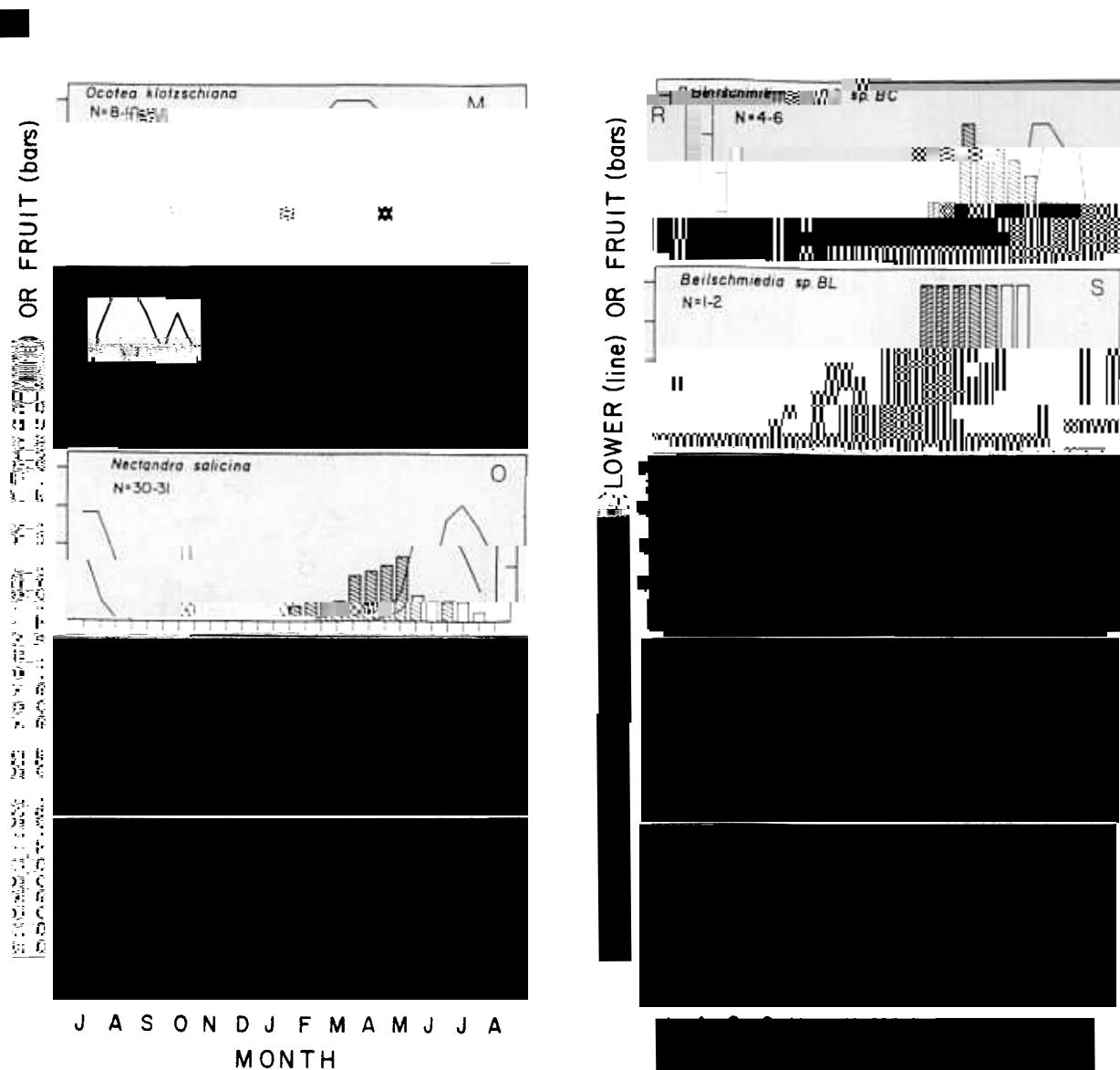
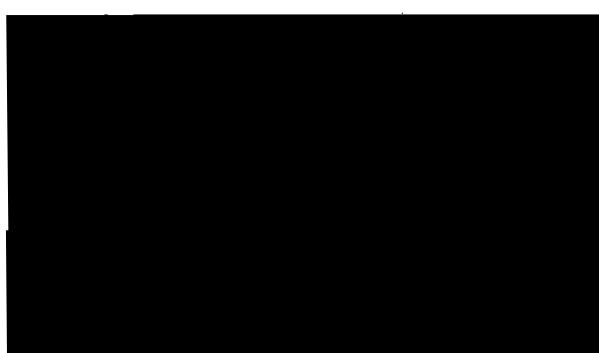


Fig. 1a–v. Seasonal flowering and fruiting phenologies of 22 bird-dispersed tree species in the Lauraceae of Monteverde, Costa Rica in 1980–1981. The number of individuals (N) used for each species is indicated in the legend. Symbols above the bars indicate flower phenology: R = red; W = white; B = blue; BC = blue and cream. Symbols below the bars indicate fruit phenology: S = smooth; II = irregularly ribbed. The x-axis indicates months from July (J) to June (A).



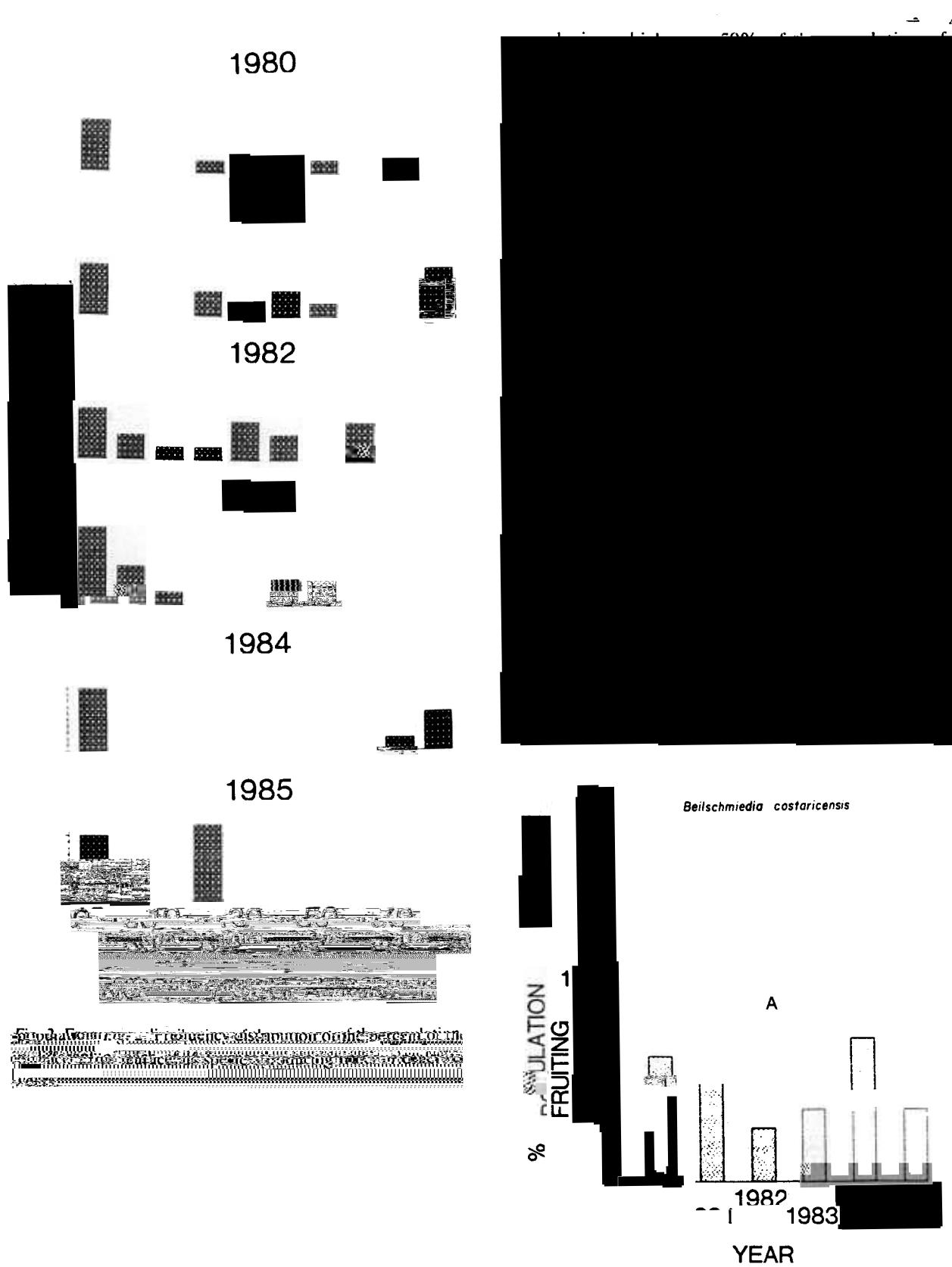
niae tricarunculata), Emerald Toucansets (*Aulacoc-*

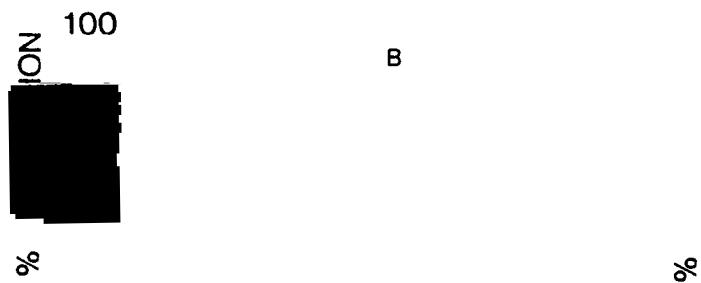
Lauraceae quantifying reproduction in the forested reproduction in Since June 1980 I have mon-

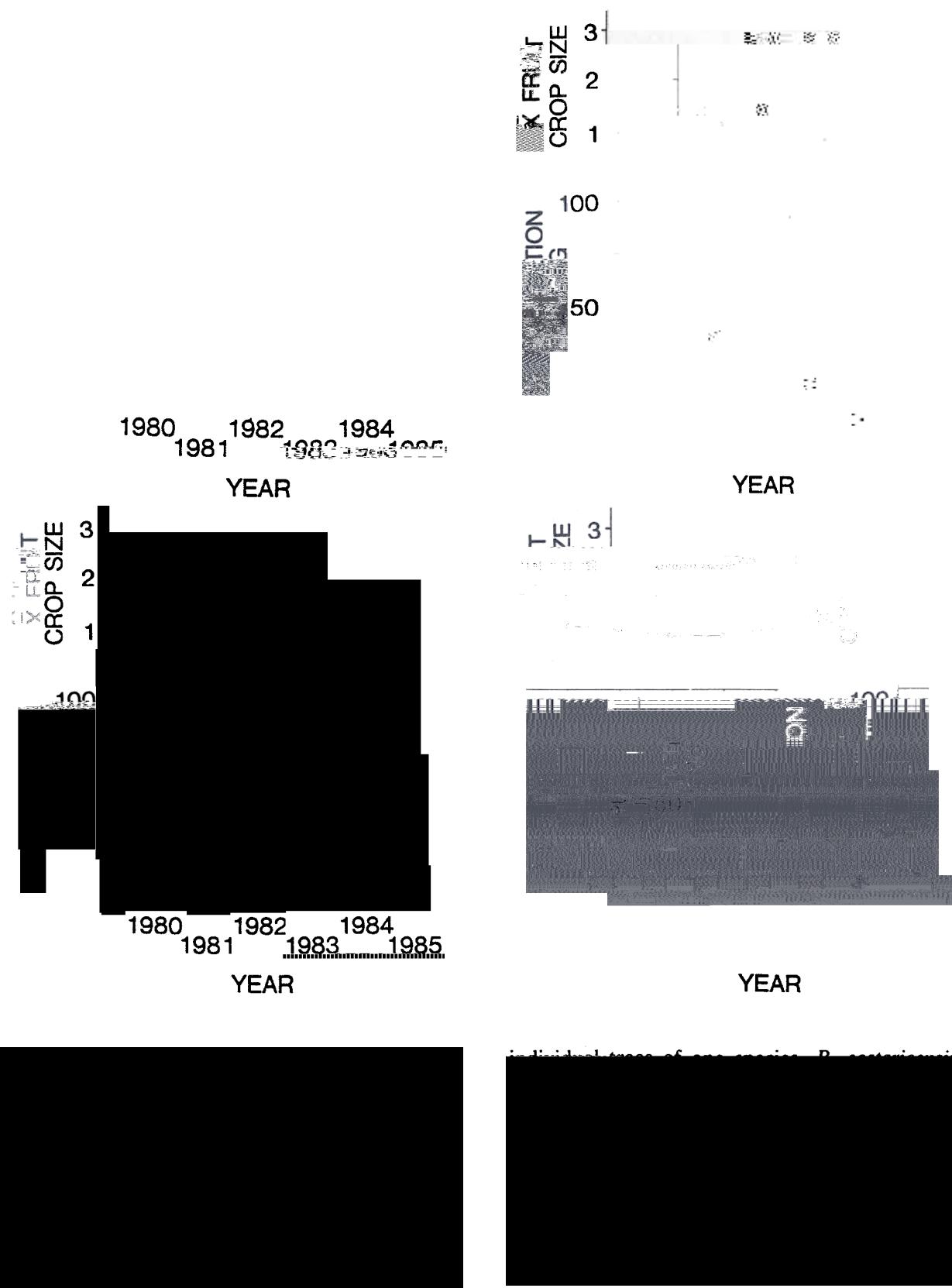
286 marked trees, representing 22 species. Individual trees of six of these species were observed during 1979 as well. For the 16 common species,

Results

Tree production fluctuated annually (Fig. 2; Fig. 3)



Beielschmiedia sp. BC



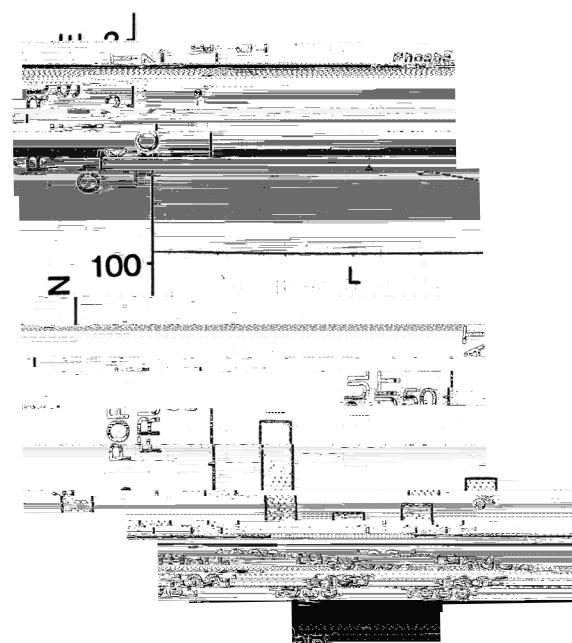
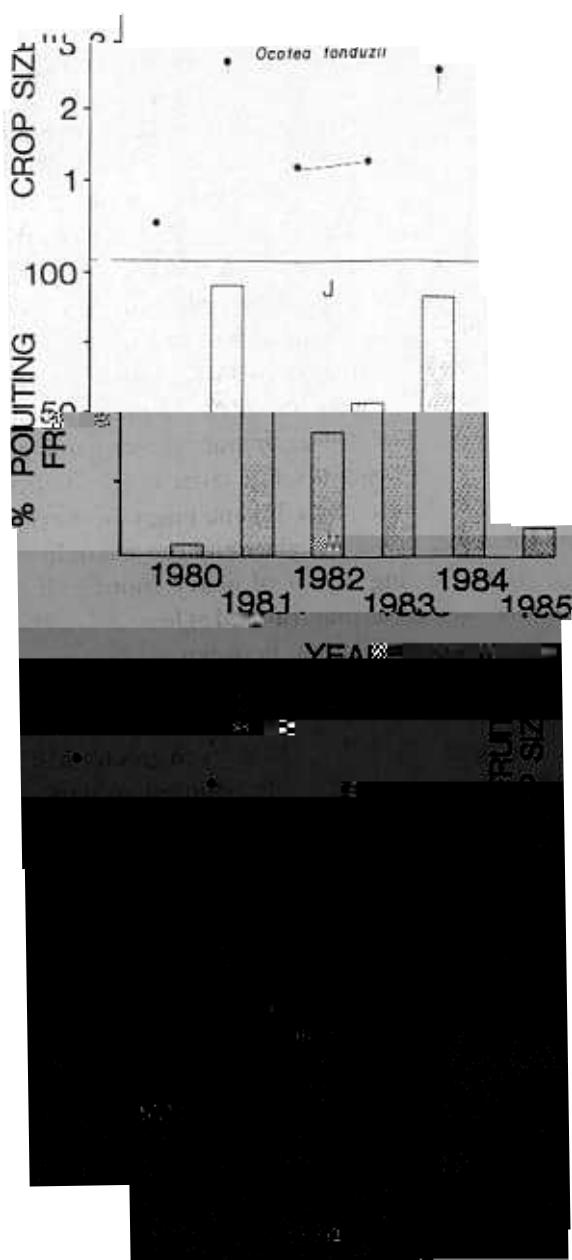


Fig. 1. Crop size and % polluting fruiting (± 1 SD) for 1980 (top) and 1985 (bottom) for *Ocotea tunduzii*.

other, yet they showed distinct cycles (Table 1).



ship between fruit production in a given year and

the number of successive plant-years in which

fruiting occurred in the same tree.

There appear to be three general reproductive pat-

terns within the Lauraceae: erratic moderate-level

fruit production, periodic prolific fruit production,

and periodic low-level fruit production.

The first pattern is represented by 11 species

(Table 1) which have correlation coefficients

between fruiting vs. successive plant-years

which are either negative or near zero.

The second pattern is represented by 10 species

(Table 2) which have correlation coefficients

between fruiting vs. successive plant-years

which are positive and significant at the .01 level.

The third pattern is represented by 10 species

(Table 3) which have correlation coefficients

between fruiting vs. successive plant-years

which are positive and significant at the .05 level.

It is interesting to note that the species which

have the highest correlation coefficients between

fruiting and successive plant-years are those which

have the lowest mean annual fruit production.

It is also interesting to note that the species

which have the highest mean annual fruit produc-

tion are those which have the lowest correlation

coefficients between fruiting and successive

plant-years.

TABLE 1. Tree species showing negative or near zero correlation coefficient between fruiting vs.

successive plant-years.

| Tree species | Correlation coefficient: fruiting vs. successive plant-years | No. successive plant-years | Correlation coefficient: fruiting vs. vegetative growth | No. successive plant-years | Number of species |
|-------------------------|--|----------------------------|---|----------------------------|-------------------|
| <i>Alpinia zerumbet</i> | -.22 | 21 | -.33 | 27 | 6 |
| <i>Alpinia zerumbet</i> | -.44** | 42 | -.56 | 55 | 12 |
| <i>Alpinia zerumbet</i> | -.07 | 24 | .10** | 31 | 7 |
| <i>Alpinia zerumbet</i> | .00 | 102 | .10** | 135 | 30 |
| <i>Alpinia zerumbet</i> | .05 | 104 | .10** | 135 | 29 |
| <i>Alpinia zerumbet</i> | -.43 | 21 | .27 | 27 | 6 |
| <i>Alpinia zerumbet</i> | .58** | 56 | .73 | 73 | 16 |
| <i>Alpinia zerumbet</i> | -.28 | 7 | .30 | 30 | 5 |
| <i>Alpinia zerumbet</i> | -.07 | 20 | .27 | 27 | 6 |
| <i>Alpinia zerumbet</i> | .13 | 39 | .52 | 52 | 12 |
| <i>Alpinia zerumbet</i> | -.42** | 110 | .52 | 110 | 30 |
| <i>Alpinia zerumbet</i> | -.18 | 34 | .49 | 49 | 12 |
| <i>Alpinia zerumbet</i> | .41 | 12 | .15 | 15 | 3 |
| <i>Alpinia zerumbet</i> | .23* | 85 | .13 | 13 | 25 |
| <i>Alpinia zerumbet</i> | -.03 | 39 | .56 | 56 | 14 |

* P<.01

** P<.05

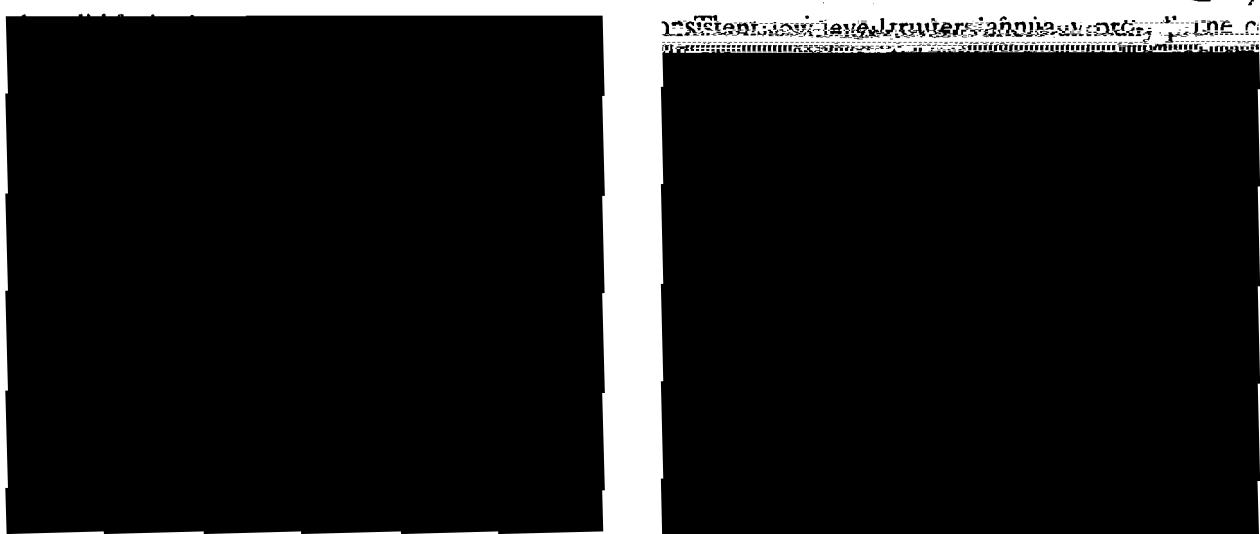


Table 3. Three general patterns of fruit production within the Lauraceae at Monteverde. Mean crop size and variability in crop size refer

| Tree species | Fruit size (g) | Mean fruit crop size | Variability in crop size consistency | Consistency of individuals |
|--|----------------|----------------------|--------------------------------------|----------------------------|
| Erratic moderate level fruiters | | | | |
| <i>Phoebe mexicana</i> | | | moderate | |
| <i>Ph. neurophylla</i> | | | moderate | |
| <i>Nectandra gentlei</i> | | | high | |
| * <i>Persea sp. RP</i> | | | moderate | |
| <i>Ocotea sp. FL</i> | | | moderate | |
| * * <i>N. sp. NC</i> | | | | |

Importance of lawlessness for individuals

The ‘failure’ of law

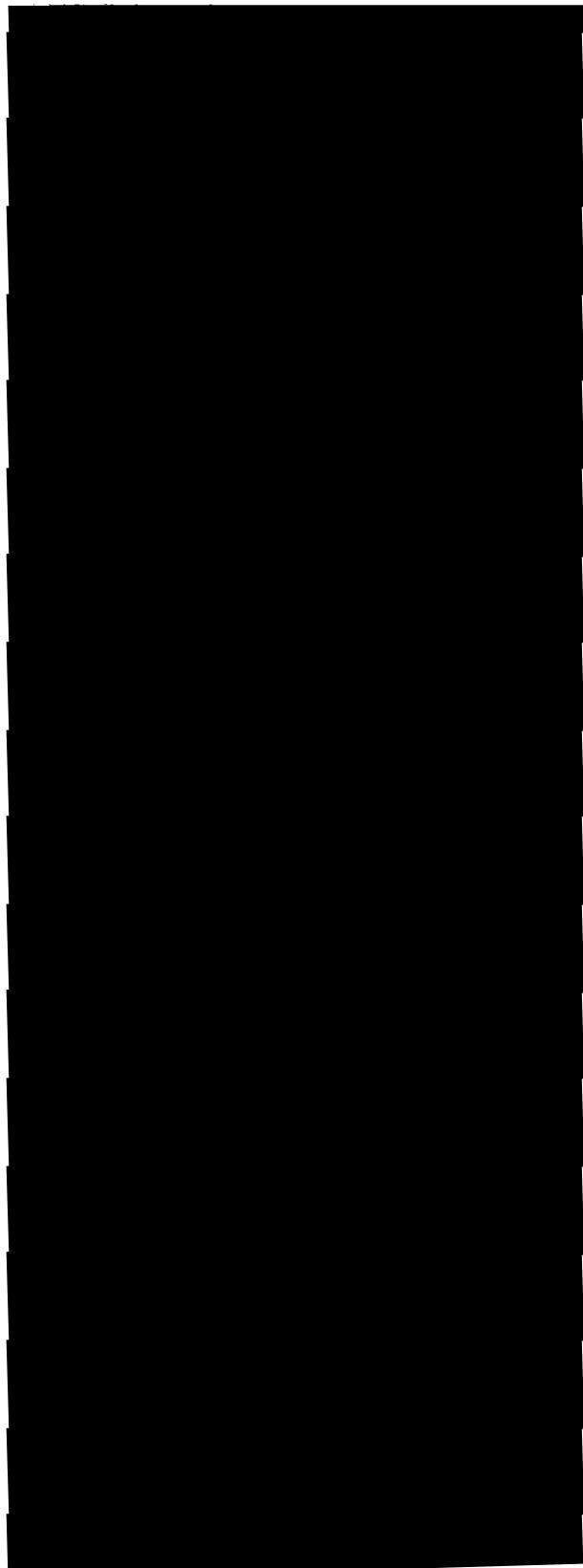
their use of discourses, and the ways in which they construct their identities.

The ‘failure’ of lesson 1 can be explained by the fact that the teacher did not have a clear idea of what he wanted to teach. He had no clear objectives and did not know what he wanted his students to learn. This lack of clarity led to a lack of focus in the lesson, which resulted in a lack of engagement from the students. The teacher’s lack of preparation and knowledge of the subject matter also contributed to the failure of the lesson. He did not have enough information to answer his students’ questions or provide them with meaningful feedback. The teacher’s lack of enthusiasm and passion for the subject matter also contributed to the failure of the lesson. He did not seem to care about the material he was teaching, which made it difficult for his students to stay interested and engaged. The teacher’s lack of communication skills and ability to connect with his students also contributed to the failure of the lesson. He did not effectively communicate his ideas and did not make an effort to understand his students’ perspectives. The teacher’s lack of respect for his students and their opinions also contributed to the failure of the lesson. He did not value his students’ input and did not encourage them to participate in the discussion. The teacher’s lack of respect for his students and their opinions also contributed to the failure of the lesson. He did not value his students’ input and did not encourage them to participate in the discussion.

10. The following table summarizes the results of the study. The first column lists the variables used in the model, the second column lists the estimated coefficients, and the third column lists the standard errors.

| | | | | |
|-------------------------|-----|------|------|------|
| <i>B. costaricensis</i> | 3.9 | 2.0 | 0 | 0 |
| <i>N. sp. NC</i> | 0.5 | 3.3 | 0 | 2.0 |
| | 0 | 0.2 | 0 | 0 |
| | 0 | 0 | 0 | 0 |
| | 1.1 | 0 | 72.6 | 0 |
| | 1.1 | 0 | 0 | 0 |
| | 2.2 | 5.8 | 0 | 2.0 |
| | 0 | 0.1 | 0 | 2.4 |
| | 0.2 | 2.97 | 27.4 | 36.9 |

Procnias seems related to their dependence on lauraceous fruits (Snow, 1973; see also Crome, 1975).



vere among the erratic and periodic fruiters (Table 3), and rather low in most species of consistent, low-level fruiters (although it is not obvious whether this is cause or effect of phenology). Post-

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A high-resolution grayscale micrograph of a complex integrated circuit die. The die features a dense grid of rectangular pads, several large central blocks of logic, and a prominent central rectangular area with a fine grid pattern. The overall structure is highly symmetrical and organized.

Variance in reproductive success among trees

Several species in this study produced perplexingly few fruits over a six-year period. *Ocotea* sp. RP, a

their seed or seedling biology suggests unusually high sensitivity to environmental factors.

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1000-10000 m² yr⁻¹

the first time in the history of the world, the people of the United States have been called upon to decide whether they will submit to the law of force, or the law of the Constitution. We have now an opportunity unprecedented in the history of the world, to decide whether we will submit to the law of force, or the law of the Constitution. We have now an opportunity unprecedented in the history of the world, to decide whether we will submit to the law of force, or the law of the Constitution. We have now an opportunity unprecedented in the history of the world, to decide whether we will submit to the law of force, or the law of the Constitution.

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10. The following table summarizes the results of the study. The first column lists the variables, the second column lists the sample size, and the third column lists the estimated effect sizes.

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ANSWER The answer is 1000.

Conclusion

Alvim, P. de T. and R. Alvim. 1978. Relation of climate to

growth potential in eucalyptus and other trees as living

Acknowledgements

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