A study of poplar resistance to *Phratora (= Phyllodecta) vitellinae* L. (Col., Chrysomelidae)

2. Field observations

By Y. Finet and J.-C. Gregoire

Abstract

The choice of the phytophagous Chrysomelid *Phratora (= Phyllodecta) vitellinae* between different *Populus* clones, previously studied by greenhouse experiments, was estimated by field observations in experimental plots in a nursery. A first series of observations concerned 3 clones: 'Ghoy', 'Columbia River' and 'Beaupré'.

A second series concerned 8 clones: 'Ghoy 1', 'Ghoy', 'Gaver', 'Robusta vert' 'Fritzy Pauley', 'Columbia River', 'Unal' and 'Beaupré'. Food choice and oviposition site choice were both recorded. Food choice was estimated by counting the number of beetles on each plant. Oviposition preferences were ascertained by counting the number of eggs and larvae.

In the second series of experiments, we analysed the temporal fluctuations of the results. The variation from year to year and the modifications within a year were considered.

The results were as follows: the order of increasing "resistance" (negative choice by the insects) was: *P. trichocarpa* × *deltoïdes* ('Unal' and 'Beaupré') and 'Columbia River' *(P. trichocarpa); P. deltoïdes* × *nigra* ('Gaver' and 'Ghoy') and 'Fritzy Pauley' *(P. trichocarpa); P. nigra* ('Ghoy 1').

The field observation corroborated the high resitance of *P. nigra* 'Ghoy 1' to *Ph. vitellinae*.

There was a significant correlation between the feeding and egg-laying preference.

The distribution of the insects may depend considerably on the year of observation. Within a year, the closer the surveys in time, the greater the concordance between the observations made.

1 Introduction

In a first study (Finet and Gregoire 1981), we reported greenhouse experimental results concerning the relations between a Chrysomelid beetle, *Phratora (= Phyllodecta) vitellinae* L. and various *Populus* clones.

We observed that adults showed statistically significant feeding preferences, that they showed no significant preferences for egg-laying, and that there was a strong correlation between the insects' level of presence on a plant and the consumed leaf areas. This last observation implies that counting the beetles on poplar plants may be considered as a close appreciation of feeding preferences.

These results have now been completed by field observations in experimental plots in a nursery. For similar work on other insects and poplars, see Lapietra (1973), Arru (1973a), Harrell et al. (1981).

2 Material and methods

2.1 Poplars

Successive series of observations were made during the years 1976, 1978, 1979 and 1980.

In 1976, we compared three clones: 'Ghoy' *(Populus deltoïdes* × *nigra)*; 'Beaupré' *(P. trichocarpa* × *deltoïdes)* and 'Columbia River' *(P. trichocarpa)*.

In the other three years, these clones were compared again, as well as five additional ones: 'Ghoy 1' *(P. nigra)*; 'Gaver' and 'Robusta vert' (both *P. deltoïdes* × *nigra)*; 'Fritzy Pauley' *(P. trichocarpa)*; and 'Unal' *(P. trichocarpa* × *deltoïdes).*

2.2 Experimental plots

The experimental plots were located in a nursery belonging to the "Rijksstation voor Populieren-teelt" at Geraardsbergen, Belgium. The nursery is situated near the village of Grimminge, on Ypresian clay.

2.3 Experimental design

In 1976, there were 5 blocks containing each three parallel rows of 40 cuttings of that year, one clone per row, in random order in each block. Distance between plants in a row was 60 cm, distance between rows was 2 m.

During the 3 other years, the experimental design was the same, except that there were 8 rows per block (corresponding to 8 experimental clones), with 20 plants per row. In 1978, the plants were cuttings of the year; in 1979, we used the same cuttings, 2 years old, which were cut back during the winter 1979 and gave new shoots in 1980. These were then used as the experimental material.

2.4 Experimental procedure

Feeding-choice and egg-laying preferences were estimated by regularly counting the adults and the eggs and larvae on the plants.

In 1976, the insect population was rather low and we used the total numbers of individuals per clone and per block in the statistical analysis.

In the following years, population levels were higher and we used the numbers of insects per plant in the statistical analysis. Successive surveys did not always cover all the experimental blocks (see table 1).

3 Results

3.1 Observations made in 1976

Our overall results appear in fig. 1. As is may be seen there, we had only two occasions to count sufficient numbers of larvae (26. 8 and 3. 9) and adults (18. 10. and 30. 10.) Therefore we restricted our analysis to 2 sets of data for each developmental stage. These data are displayed in figs. 2 and 3. Furthermore, due to high plant mortality among the 'Beaupré' plants, block 1 was excluded from the statistical analysis.

3.1.1 Oviposition choice

This was assessed by counting the larvae on the plants. Two 2-way analyses of variance (clone/block) were made using the data of 26. 8. and 3. 9. They revealed no significant differences at the 0.05 level between clones ($F[26. 8.] = 1,37^{NS}$; $F[3.9] = 0,35^{NS}$, with 2 and 6 d.f.), nor between blocks ($F[26. 8.] = 0,86^{NS}$; $F[3. 9.] = 1,40^{NS}$, with 3 and 6 d.f.). (Throughout this report, * indicates a significant result: $p \leqslant 0,05$; ** a highly significant result: $P \leqslant 0,01$; *** a very highly significant result: $p \leqslant 0,001$, and NS a non significant result: $P > 0,05$).

3.1.2 Adults' feeding choice

Similarly, 2-way analyses of variance were made with the data of 18. 10 and 30. 10. They revealed no significant difference at the 0.05 level between clones

(F[18. 10.] = $0,85^{NS}$; F[30. 10] = $2,04^{NS}$, with 2 and 6 d.f.), nor between blocks (F[18. 10.] = $1,46^{NS}$; F[30. 10.] = $1,14^{NS}$, with 3 and 6 d.f.).

Although there are no statistically significant differences between clones, some rather striking tendencies appear:

- 'Ghoy' was globally less chosen than the two other clones (see fig. 1);
- There was an increase in the number of insects on the 'Columbia River' plants during the second observations.

This could correspond to the fact that late in the season as it was, the leaves of this clone stayed in much better condition than those of 'Ghoy' and 'Beaupré'.

3.1.3 Relation between feeding-choice and oviposition choice

There is a good parametric correlation between total numbers of adults and of larvae counted throughout the year per clone and per block: r = $0,81^{***}$, with 14 degrees of freedom: see fig. 4.

Fig. 1. Egg-laying and feeding choices: overall results of the 1st series of field observations
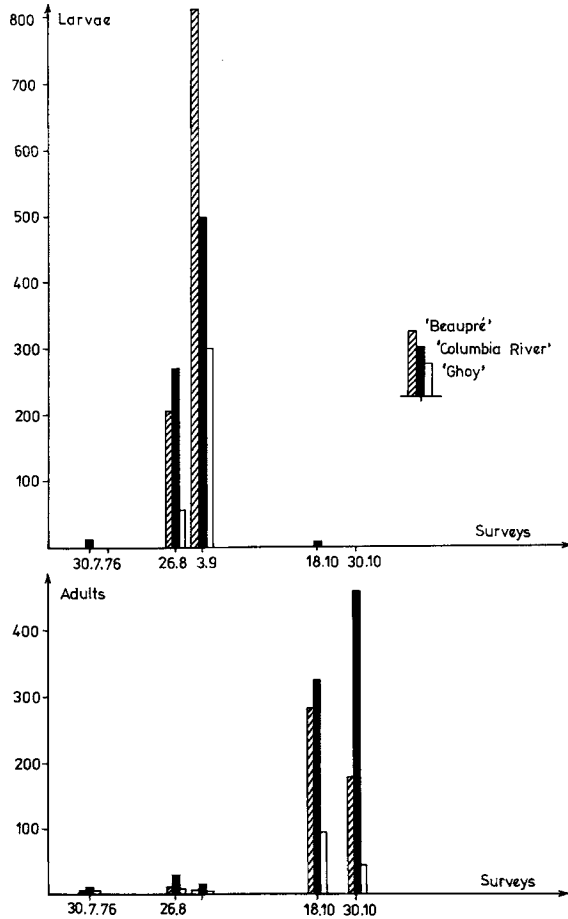
3.2 Observations made in 1978, 1979 and 1980

3.2.1 Adults' feeding choice

3.2.1.1 Estimation of the preferences

The individual results of our observations are presented in table 1. These results were submitted to a 2-way analysis of variance (clones/successive surveys).

Comparing the clones, we obtained: F = $3,84^{***}$, with 7 and 112 d.f.

Testing the interaction between clones and successive surveys, we obtained: F = $18,45^{***}$, with 112 and 3987 d.f.

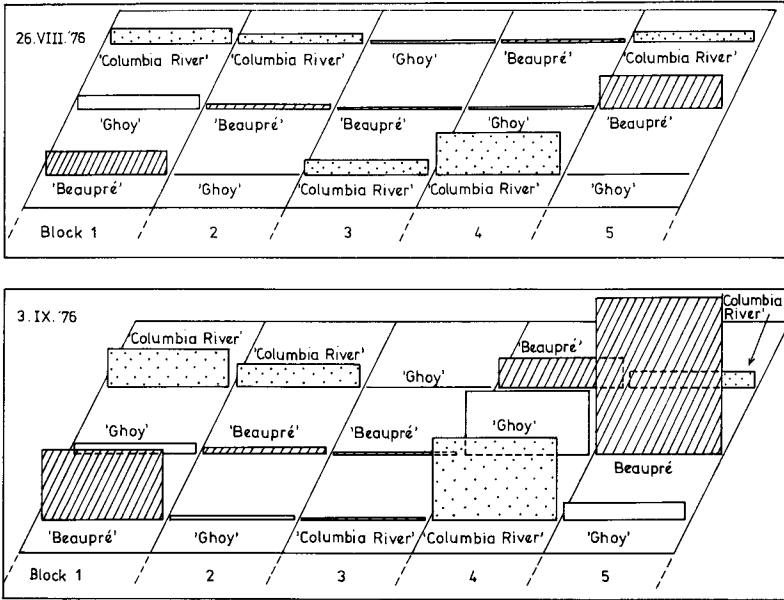This highly significant interaction means that the insects' choice varied

Fig. 2. Egg-laying choice: distribution of the larvae and eggs on the plants in the nursery. Data utilised in the analysis of variance (1st series of observations)
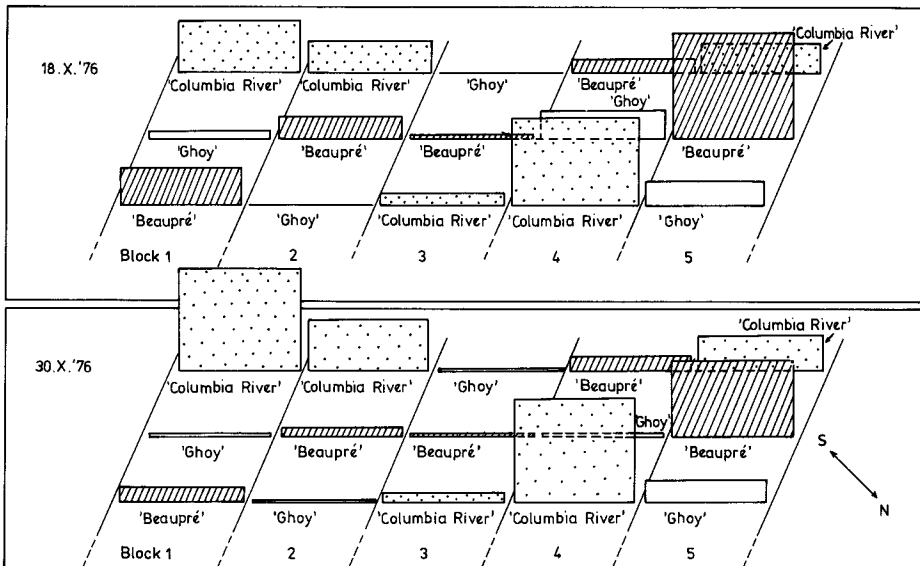

Fig. 3. Feeding choice: distribution of the adults on the plants in the nursery. Data utilised in the analysis of variance (1st series of observations)

sometimes very much from one survey to another. Since these surveys were made at very different periods, a first conclusion would be that insects' choice could be strongly influenced by the period in the year.

3.2.1.2   Fluctuations of the results during the course of time

We tried to analyse this hypothesis further. We estimated concordance or discordance between the results of the ten surveys made between August 1978 and September 1979, using KENDALL's concordance coefficient (SIEGEL 1956).
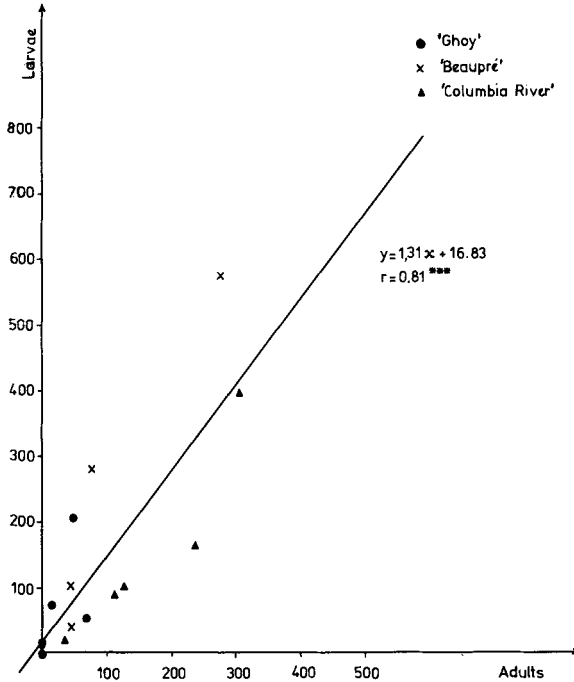

Fig. 4. Correlation between feeding-choice and oviposition choice in the 1st series of field observations

Such a coefficient may be computed when there are at least 3 values to compare.

Fig. 5 shows the evolution of KENDALL's concordance coefficient (W), as a function of the number of surveys considered, in chronological order. Two curves are shown: *curve 1* concerns the ranks obtained for all the clones studied, whereas *curve 2* concerns these same clones with the exception of *P. nigra* 'Ghoy 1', which remained constantly the least attractive, and was the only clone that kept identical scores (in terms of rank) in all the surveys.

Fig. 5 also shows the curves representing the theoretical limits at p = 0.05 and p = 0,01 for the values of the KENDALL's coefficient (W).

It may be seen that concordance is good and even becomes highly significant with 6 or more surveys, if the data concerning 'Ghoy 1' are included. On the other hand, the results obtained with the other 7 experimental clones when 'Ghoy 1' is excluded vary apparently at random from one survey to another:

Table 1. Feeding choice: results of the field observations (2nd series of observations)

| Surveys (date and blocks examined)	'Ghoy 1'	'Ghoy'	'Gaver'	'Robusta vert'	'Fritzy Pauley'	'Columbia River'	'Unal'	'Beaupré'	TOTALS
(1) (1.8.78) Blocks 1 to 5	1 [1]	162 [5]	103 [3]	134 [4]	101 [2]	352 [8]	171 [6]	233 [7]	1.257
(2) (21.8.78) Blocks 1 to 5	21 [1]	437 [6]	335 [5]	161 [2]	230 [3]	316 [4]	478 [7]	481 [8]	2.459
(3) (18.10.78) Blocks 1 to 5	50 [1]	461 [2]	739 [3]	1204 [5]	1185 [4]	1508 [7]	1255 [6]	2904 [8]	9.306
(4) (29.5.79) Block 1	70 [1]	427 [7]	325 [6]	743 [8]	209 [2]	299 [5]	283 [3]	293 [4]	2.649
(5) (14.6.79) Block 2	7 [1]	160 [8]	121 [7]	57 [4]	89 [5]	113 [6]	40 [3]	14 [2]	601
(6) (28.6.79) Blocks 3 and 4	16 [1]	134 [7]	132 [6]	56 [4]	94 [5]	137 [8]	55 [3]	34 [2]	658
(7) (12.7.79) Block 5	2 [1]	45 [6,5]	45 [5]	26 [5]	16 [4]	51 [8]	11 [2,5]	11 [2,5]	207
(8) (25.7.79) Block 4	8 [1]	91 [7]	105 [8]	85 [6]	18 [2]	72 [5]	49 [4]	27 [3]	455
(9) (5.9.79) Block 5	12 [1]	57 [6]	67 [8]	24 [3]	27 [4]	58 [7]	29 [5]	21 [2]	295
(10) (25.9.79) Block 3	5 [1]	65 [6]	38 [3]	9 [2]	84 [8]	44 [5]	67 [7]	40 [4]	352
(11) (11.6.80) Block 5	0 [1]	23 [6]	16 [5]	7 [2]	13 [3,5]	13 [3,5]	51 [7]	88 [8]	211
(12) (13.7.80) Block 3	2 [1]	26 [2]	38 [5,5]	38 [5,5]	27 [3]	57 [8]	31 [4]	40 [7]	259
(13) (18.7.80) Block 2	0 [1]	25 [4]	24 [3]	28 [5]	17 [2]	45 [8]	31 [6]	41 [7]	211
(14) (11.8.80) Block 2	1 [1]	17 [6,5]	7 [3]	3 [2]	17 [6,5]	12 [4]	15 [5]	20 [8]	92
(15) (21.8.80) Block 1	0 [1,5]	3 [5]	0 [1,5]	4 [6]	1 [3]	2 [4]	29 [8]	14 [7]	53
(16) (13.10.80) Block 5	0 [1]	5 [3]	10 [7]	4 [2]	7 [4]	9 [5,5]	33 [8]	9 [5,5]	77
(17) (30.10.80) Block 4	2 [1]	35 [6,5]	27 [4]	31 [5]	26 [3]	7 [2]	57 [8]	35 [6,5]	220
TOTALS	197 [1]	2173 [4]	2132 [2]	2614 [5]	2161 [3]	3095 [7]	2685 [6]	4305 [8]	19.362
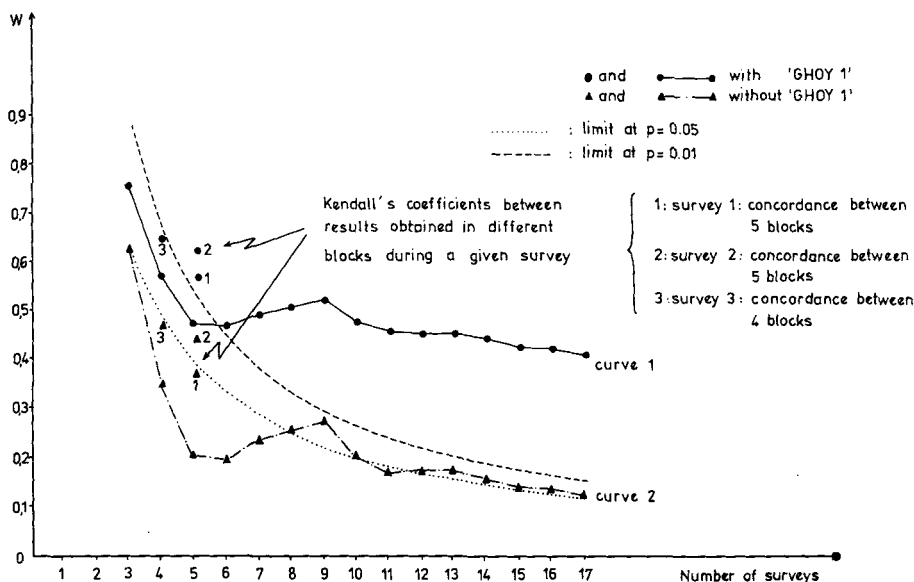
Fig. 5. Evolution of KENDALL's concordance coefficient (W) between the results, as a function of the number of surveys considered, in chronological order, in the 2nd series of field observations (feeding choice)

the significant concordance between them is only barely obtained with more than 8 surveys.

It is also possible to compute W between blocks during a given survey, provided that the number of blocks is greater than three. The corresponding values of W are also given in fig. 5 for three distinct surveys. Computation of correspondance coefficients was possible for the three first surveys, made in 1978, since each of them contained 4 or 5 experimental blocks.

Both including and excluding 'Ghoy 1', there is a better concordance between the results obtained in 4 or 5 blocks during the same survey than between the results obtained during distinct surveys, for this analysis, the 4 or 5 first surveys of the series of 17, taken as a basis for comparison (see again fig. 5).

This suggests that the important variability observed in the field is more temporal than spatial: the results vary essentially as a function of the moment the surveys took place.

Of course, linking variations in our results to a time-scale does not make a wholly satisfactory explanation of the results obtained: many different factors, depending themselves on time, may play a role: climatic conditions, seasonal variations in leaf quality, growth of the plants, emergence of the 2nd generation of adult beetles, redistribution of the insects on the plants after hibernation, etc.

We analysed the effects of two factors: the variation from year to year, and the modifications within a year. We classified the clones per order of increasing infestation level for each held survey (ranks from 1 to 7: 'Ghoy 1' excluded because of the constancy of results obtained with this very resistant clone).

Variation from year to year

For each of the years 1978, 1979, 1980, we computed the KENDALL's concordance coefficient (W) for the results obtained during the different surveys each year. The value of this coefficient depends upon the number of surveys considered. As we wanted to compare coefficients which did not depend on the number of surveys, we calculated a relative concordance coefficient $C : C = \dfrac{W}{W_{0,05}}$ (ratio between the observed KENDALL's coefficient W and the same coefficient corresponding to a theoretical signification level p = 0.05).

We also computed C for the whole set of field surveys made during the 3 years 1978, 1979 and 1980.

We obtained: 1978 (3 surveys): C = 1,005*
1979 (7 surveys): C = 1,645**
1980 (7 surveys): C = 1,341**
1978 + 1979 + 1980 (17 surveys): C = 1,074*

These values suggest that the results obtained during the same year are more homogeneous than the results obtained during different years.

We also computed C for the sets of field surveys corresponding to the two by two combinations of the years 1978, 1979 and 1980.

We obtained: 1978 + 1979 (10 surveys): C = 0,995[NS]
1979 + 1980 (14 surveys): C = 0,762[NS]
1978 + 1980 (10 surveys): C = 2,127**

This shows that the most concordant results are those of the two years 1978 and 1980 considered together.

Inversely, the results of two successive years, 1978 and 1979, and 1979 and 1980, are not concordant.

This could be due to the severe cutting back of the poplars between 1979 and 1980; thus the new young growths of 1980 became similar to the first ones of 1978, whilst in 1979 the plants were very high.

We conclude that:
– passing from year to year may modify the preferences of the insects.
– the global result of any given year is not the average of ill-matched values, but, on the contrary, of significatively to very significatively concordant observations.
The distribution of the insects may thus change from year to year.

Modifications within a year

For the years 1979 and 1980, we computed a series of concordance coefficients concerning different surveys chosen during the year. All possible combinations were considered, even with surveys which were not consecutive: see fig. 6.

Along the horizontal axis, we placed the degree of remoteness of the different surveys. The degree of remoteness was evaluated by counting the number of surveys "missed" between non-consecutive surveys considered for each computation. Along the vertical axis, we put the means of all relative concordance coefficients which were calculated for different combinations having the same degree of remoteness.

Fig. 6 shows a highly significant correlation between the closeness in time
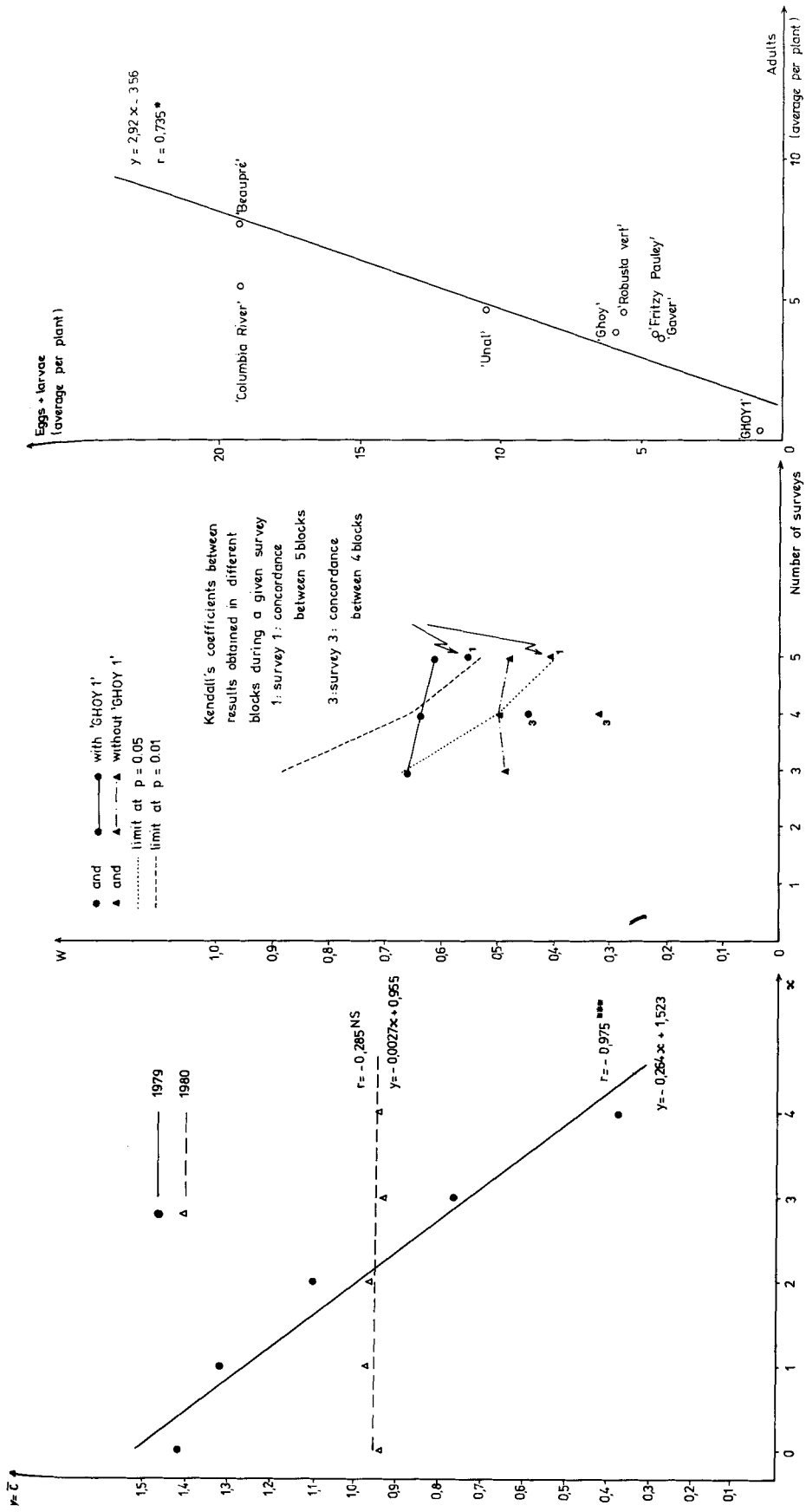
Fig. 6 (*left*). Correlation between the closeness in time between the 1979 surveys (2nd series of observations) and the concordance of the observations made during these surveys (feeding choice). – Fig. 7 (*center*). Oviposition choice: evolution of KENDALL's concordance coefficient (W) between the results, as a function of the number of surveys considered, in chronological order, in the 2nd series of field observations. – Fig. 8 (*right*). Correlation between feeding-choice and oviposition choice in the 2nd series of field observations

Table 2. Egg-laying choice: results of the field observations (2nd series of observations)

Clones / Surveys	'Ghoy 1'	'Ghoy'	'Gaver'	'Robusta vert'	'Fritzy Pauley'	'Columbia River'	'Unal'	'Beaupré'	TOTALS
(1) (1.8.78) Blocks 1 to 5	164 (1)	1253 (4)	900 (3)	1290 (5)	898 (2)	4305 (8)	2062 (6)	4058 (7)	14.930
(3) (18.10.78) Blocks 1 to 4	0 (1)	14 (3)	16 (4,5)	16 (4,5)	8 (2)	31 (7)	34 (8)	28 (6)	147
(9) (5.9.79) Block 5	0 (1)	19 (4)	46 (5)	8 (2)	92 (7)	12 (3)	98 (8)	84 (6)	361
(10) (25.9.79) Block 3	0 (2)	7 (5)	0 (2)	18 (6)	0 (2)	3 (4)	40 (7)	48 (8)	116
(11) (11.6.80) Block 5	0 (1,5)	86 (6)	56 (4)	28 (3)	76 (5)	0 (1,5)	188 (7)	313 (8)	747
TOTALS	164 (1)	1379 (5)	1020 (2)	1360 (4)	1074 (3)	4351 (7)	2422 (6)	4531 (8)	16.301

between the 1979 surveys and the concordance of the observations made during these surveys. No such correlation is observed for 1980.

The correlation observed in 1979 suggests that the distribution of the insects on the different clones varied gradually throughout the year.

3.2.2 Oviposition choice

This was assessed by counting, during some of our observations, the number of eggs and larvae on the plants. A synthesis of the individual results appears in table 2. These results were submitted to a 2-way analysis of variance (clones/ successive surveys).

Comparing the clones, we obtained:F = 3,273*, with 7 and 28 d. f.

Testing the interaction between clones and successive observations, we obtained:F = 6.87***, with 28 and 1687 d. f.

Although highly significant, this interaction is less important than in the previous case of adults' feeding choice.

This is confirmed by fig. 7, which shows the evolution of KENDALL's concordance coefficient (W) as a function of the sucessive surveys.

As for feeding choice (cf. fig. 5), two curves are presented, one including *P. nigra* 'Ghoy 1' and the other excluding it.

Only five surveys concerning oviposition choice were made. KENDALL's concordance between them becomes very good with four or five surveys, even if the data concerning 'Ghoy 1' were excluded.

This shows that the distribution of the eggs and larvae on the different poplar clones is less dependent on time than the distribution of the populations of adults on the same clones.

Moreover, fig. 7 shows the points corresponding to values of the concordance coefficient obtained between blocks during two distinct surveys. Computation of this concordance of results between blocks was possible for surveys 1 and 3 (1978) because these concerned respectively 4 and 5 experimental blocks. The concordance coefficients obtained in this case are inferior to those calculated for the comparison of 4 or 5 surveys distinct in time.

This means that, contrarily to what had been observed with feeding choice, spatial variability could be more important than temporal variability when egg-laying choice is concerned.

3.2.3 Relations between feeding-choice and oviposition-choice

A parametric correlation between the total absolute numbers of adults and of eggs counted on each clone gives a significant correlation coefficient: r = 0,735*, with 7 d. f. (see fig. 8).

4 Discussion

Previous experiments in a greenhouse allowed us to classify our experimental poplar clones along a scale of increased sensitivity: *P. nigra; P. trichocarpa; P. deltoïdes x nigra; P. trichocarpa x deltoïdes* (FINET and GREGOIRE 1981).

Globally, the results of our field observations lead to rather similar conclusions.

We may draw no conclusion from the results of the first series of observations (1976), since the scarcity of insects allowed us to examine only two

surveys for feeding-choice and two for egg-laying-choice, and since the second series of observations showed a posteriori that no significant concordance of response to each clone tested appears before 4 surveys are made in the case of egg-laying-choice, and before 7 surveys are made in the case of feeding-choice.

The second series of experiments leads to much more substantial conclusions. Tables 1 and 2 allow a classification of our experimental poplar clones along a sensitivity scale regarding egg-laying choice and feeding-choice by *Phratora vitellinae*. Such a classification is summarized in table 3, where we also present a multiple comparison of means, using NEWMAN and KEULS' method.

One of the most important results of our field-tests is the confirmation of the great resistance of *P. nigra* 'Ghoy 1' to *Ph. vitellinae*.

Inversely, the *P. trichocarpa* x *deltoïdes* ('Unal' and 'Beaupré') have been globally the most intensively attacked (see table 3).

The *P. deltoïdes* x *nigra* ('Ghoy', 'Gaver' and 'Robusta vert') seem only mildly sensitive.

The *P. trichocarpa* ('Fritzy Pauley' and 'Columbia River') seem however to be more sensitive in the nursery than in the greenhouse. This is particularly true for 'Columbia River', which has always been attacked as much as the *P. trichocarpa* x *deltoïdes*. This is perhaps linked to particular properties of our *P. trichocarpa* plants in the nursery: they displayed many lateral branches and very large leaves. The silhouette of these plants, linked with the high density of their foliage, could have visually stimulated the insects and have a certain long-range attractivity.

Table 3. Sensitivity of the experimental clones in the field

Plant choice ≡ Food choice		Oviposition choice	
P. nigra 'Ghoy 1'	(0,34)	*P. nigra* 'Ghoy 1'	(0,68)
'Gaver'	(3,68)⎤	'Gaver'	(4,25)⎤
'Fritzy Pauley'	(3,73)⎢	'Fritzy Pauley'	(4,50)⎢
'Ghoy'	(3,75)⎦	'Robusta vert'	(5,67)⎢
'Robusta vert'	(4,51)⎤	'Ghoy'	(5,75)⎦
'Unal'	(4,61)⎦	'Unal'	(10,13)
'Columbia River'	(5,33)	'Columbia River'	(18,13)⎤
'Beaupré'	(7,42)	'Beaupré'	(18,80)⎦

Between brackets are shown the mean numbers of adults or eggs observed per plant. A continuous line between two or more clones indicates that no significant difference was observed between them at the α = 0,05 level.

Thus, low differences in sensitivity are not necessarily maintained from one experimental mode to another, with poplars differing from origin, or age, or planted in dissimilar conditions.

It is thus necessary to be careful if the experimental results are not striking enough: their validity is perhaps not general, even if some differences are statistically significant in the context of a given experiment. But this is wide-common sense . . .

In particular, field studies bring results which, though perhaps very close to reality, are, as is reality itself, influenced by many fluctuating ecological elements, and thus results are reliable only after several years of observation.

Variability in the field may be spatial, but above all temporal: the results depend essentially on the moment of observation. The insects' choice is influenced above all by the year considered. In a given year, this choice is also function of time. These seasonal variations are in their turn influenced by insect-dependent factors (mobility depending on the climate, spring migration from the hibernation quarters, occurrence of the second generation peak, . . .), and by plant-dependent factors (date of apparition of the first shoots – differing from clone to clone –, modifications, not always synchronous, of physiological features, or of the phagostimulant or deterrent properties of the different clones, . . .).

About egg-laying choice, we may say that here it is narrowly linked to feeding-choice. However, egg-laying choice seems to be more independent of the year or the season.

As already suggested by our greenhouse experiments (FINET and GREGOIRE 1981), our field observations lead us to suppose that 'Ghoy 1' is at the upper end of a scale of increasing resistance to *Ph. vitellinae*. In the course of hybridization, most of the *P. nigra* would bring along "*vitellinae* resistance genes". On the other hand, *P. deltoïdes* would generally bring "sensitivity genes". Indeed, the hybrids *P. deltoïdes* x *nigra* present generally the most intermediate features. ARRU (1973b) reports this for different species of Coleoptera (*Byctyscus populi* L., *Byctyscus betulae* L., *Phratora vitellinae* L., *Cryptorrhynchus lapathi* L., *Saperda carcharias* L., *Agrilus suvorovi populneus* Schaef., and *Melanophila picta* Pall.):
- of the 2 clones of *P. nigra* tested, both are resistant;
- of the 9 clones of *P. deltoïdes* tested, all nine are sensitive;
- of the 17 clones of *P. deltoïdes* x *nigra* tested, 11 are resistant and 6 are sensitive.

However, *P. nigra* may be sensitive to other insects, to which, inversely, the *P. deltoïdes* are often resistant. For some species of Homoptera, for instance, ARRU (1973b) reports that:
- of the 6 clones of *P. nigra* tested, all 6 are sensitive
- of the 6 clones of *P. deltoïdes* tested, 5 are resistant and one is sensitive.
- of the 12 clones of *P. deltoïdes* x *nigra*, 5 are resistant and 7 are sensitive.

When Lepidoptera species are considered, the characteristics of the two species are less clear-cut:
- of the 9 clones of *P. nigra*, 6 are resistant and 3 are sensitive.
- of the 4 clones of *P. deltoïdes*, all 4 are resistant.
- of the 15 clones of *P. deltoïdes* x *nigra*, 6 are resistant and 9 are sensitive.

It thus appears that, in general, the hybrids *P. deltoïdes* x *nigra* present intermediate characteristics.

Acknowledgements

Zusammenfassung

Zur Resistenz von Pappeln gegenüber Phratora (= Phyllodecta) vitellinae L. (Col., Chrysomelidae).
2. Freilandbeobachtungen

Auf Experimentalparzellen in einer Baumschule wurde die Empfindlichkeit verschiedener Klone von *Populus* spp. gegenüber der pflanzenfressenden Chrysomelide *Phratora* (= *Phyllodecta*) *vitellinae* L. untersucht.

Eine 1. Beobachtungsreihe bezog sich auf 3 Klone: 'Ghoy', 'Columbia River' und 'Beaupré', eine 2. Reihe auf 8 Klone: 'Ghoy 1', 'Ghoy', 'Gaver', 'Robusta vert', 'Fritzy Pauley', 'Columbia River', 'Unal' und 'Beaupré'.

Die Protokollaufnahmen betrafen sowohl die Nahrungswahl der Imago als auch die Wahl der Brutstätten. Die Nahrungswahl wurde schätzungsweise erfaßt durch Abzählen der Imagines auf jeder Pflanze. Die Bevorzugung der Brutstätten wurde durch Abzählen der Eier und der Larven festgelegt.

Bei der 2. Beobachtungsreihe wurden auch die Schwankungen der Ergebnisse in bezug auf die Zeit analysiert. Dabei wurden die Veränderungen von Jahr zu Jahr sowie die Veränderungen innerhalb ein und desselben Jahres erfaßt.

Folgende Ergebnisse wurden gewonnen.

Die Reihenfolge zunehmender Widerstandsfähigkeit (negative Wahl der Insekten) war: *P. trichocarpa* x *deltoïdes* ('Unal' und 'Beaupré') und 'Columbia River' *(P. trichocarpa)*; *P. deltoïdes* x *nigra* ('Gaver' und 'Ghoy') und 'Fritzy Pauley' *(P. trichocarpa)*; *P. nigra* ('Ghoy 1'). Die große Widerstandsfähigkeit von *P. nigra* 'Ghoy 1' gegenüber *Ph. vitellinae* wurde durch die vorherigen Feststellungen im Gewächshaus bestätigt.

Es bestand ein deutlicher Zusammenhang zwischen der Nahrungswahl und der Wahl der Brutstätten.

Die Verteilung der Insekten auf die verschiedenen Klone hing stark vom jeweiligen Jahr ab. Im Laufe eines Jahres war ein Zusammenhang festzustellen zwischen den Ergebnissen zeitlich naheliegender Protokollaufnahmen und der Konkordanz (concordance coefficient of Kendall), die sich aus den Beobachtungen dieser Protokollaufnahmen ergibt.

References

ARRU, G. M., 1973a: Resistance of poplars to the Mulberry scale (*Pseudaulacaspis pentagona* Targ.). - Preliminary tests. FAO/IPC Working Group in Insects. IUFRO Working Party on Poplar Resistance to Insects, Wien, 1973.

—, 1973b: A review of the resistance of Poplars to insects from italian literature. FAO/IPC Working Group on Insects. IUFRO Working Party on Poplar Resistance to Insects, Wien, 1973.

FINET, Y.; GREGOIRE, J. C., 1981: A study of Poplar resistance to *Phyllodecta vitellinae* L. (Col., Chrysomelidae). 1. Greenhouse experiments. Z. ang. Ent. *91*, 355–367.

HARRELL, M. O.; BENJAMIN, D. M.; BERBEE, J. G., 1981: Insects associated with tissue-cultured *Populus* x *euramericana* in Central and Southern Wisconsin. Forestry Research Notes no. 244. Pre-publ. January 1981.

LAPIETRA, G., 1973: Insect resistance in 1 year-old poplars. Preliminary test. FAO/IPC Working Group on Insects. IUFRO Working Party on Poplar Resistance to Insects, Wien, 1973.

SIEGEL, S., 1956: Non-parametric Statistics for the behavioral sciences (International Student Edition). McGraw-Hill Kogakusha, Ltd.

Address of the first named author: YVES FINET, Research assistant F.N.R.S., Universite Libre de Bruxelles, Faculté des Sciences, Laboratoire de Biologie animale et cellulaire (CP 160) Av. F.D. Roosevelt 50, B-1050 Bruxelles