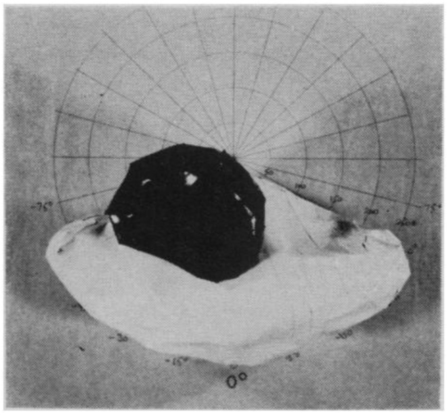

Fig. 3. Photograph of the shape (contours of zero electron density) of one ribosome of the helix. The helical axis passes through the origin of the polar coordinates, which give the scale of the model. Small subunit in black, large subunit in white.

subunit of any one ribosome is making contact across the helix axis with the central part of the large subunit of the next ribosome up the helix.

In order to interpret the diffraction pattern of Fig. 2, it was necessary to assign phases to the observed intensities. This has classically been done by assuming trial structures. Since previous work (*1*) had provided a clear interpretation of the helical packing of the ribosomes within these crystals, I felt that a trial structure consisting of "point" ribosomes placed on this helix required the fewest possible assumptions concerning the distribution of matter within any one ribosome, and would therefore afford the most general starting point. The chief restriction which this approach entails is that the resultant structure has a perpendicular dyad axis of symmetry. The model presented here is the first stage in the reconstruction of the structure of the ribosomes of chromatoid bodies.

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## Plant-Herbivore Coevolution: Lupines and Lycaenids

Abstract. *Predation on lupine flowers by larvae of a lycaenid butterfly was studied by comparison of inflorescences exposed to and protected from infestation, and by comparison of lupine populations exposed to different degrees of attack. The lycaenids caused striking reduction in seed set, indicating that this small herbivore could act as a potent selective agent in lupine populations.*

Coevolutionary interactions between plants and herbivores have been studied (*1*) and may be a major source of organic diversity (*2*). The selective effect of herbivore attack on plants, except the most extreme attacks which lead to extensive defoliation, are usually discounted as having little influence on plant populations. Also discounted is the primary role of plant biochemicals as herbivore poisons (*3*). Kemp (*4*) described an example of extreme selection for procumbency in pasture plants under heavy grazing. A seemingly insignificant herbivore, the small (wing length ± 14 mm) lycaenid butterfly *Glaucopsyche lygdamus* Doubleday, may have a profound effect on the reproductive capacity of the herbaceous perennial lupine *Lupinus amplus* Greene. This supports the contention that plants are under powerful evolutionary attack by herbivores, an attack not apparent to the casual observer.

Lupine populations in the vicinity of Gothic and Crested Butte, Gunnison County, Colorado, were investigated in June and July of 1968. Female butterflies oviposited only on pubescent portions of immature inflorescences of *L. amplus*. No oviposition was observed on an inflorescence in which some flowers were opened. A comparison of two inflorescence types, both of which occur on the same plants, was made on 7 July. Eggs and egg shells were counted on 125 inflorescences without open flowers (Fig. 1) and 130 inflorescences which had open flowers at the base only (Fig. 1). The unopened portion of the inflorescence presented an oviposition environment to a female butterfly which we are unable to distinguish from an immature inflorescence, except for the presence of opened flowers below, and increased distance from, the crown of the lupine plant. Table 1 shows the very significant difference ($P \ll .01$) in egg distribution on the two types of inflorescences. Note that since the eggs and egg shells remain attached after the flowers open, all of the eggs found at this time on open flowers may have been laid on the inflorescence when it was immature.

Larvae feed primarily on the wing and keel of the corolla and the stamens which are contained within the keel (54 of 78 larvae observed were feeding in these areas). Other parts of the flower, including the ovary, are less frequently attacked. Flowers attacked by lycaenids often do not reach anthesis and subsequently absciss.

One hundred immature inflorescences (of the type shown in Fig. 1) on 36 plants of the Gothic population were tagged on 5 July. Egg counts were made on all inflorescences and roughly half were designated controls. Controls either had no eggs on them, or had unhatched eggs removed. The tagged inflorescences were censused subsequently on 6, 9, 11, 14, and 17 July. Great care was taken not to damage the flowers. Periods between censuses were not long enough to permit egg hatch, so that we could, by removing all new eggs at each census, keep the controls free of attack by *G. lygdamus* larvae. On 17 July all inflorescences were collected and examined microscopically for damage. Floral scars were counted to give the total number of flowers which could have been produced on the inflorescence (potential production). At this date all inflorescences were fully mature and each flower had ovarian development. The lycaenid larvae found ranged in size from small (newly hatched) to large

Fig. 1. (Left) Inflorescence of *Lupinus amplus* without open flowers; (right) inflorescence with open flowers at base and unopened flowers at apex.

Table 1. Distribution of *Glaucopsyche* eggs on the two types of inflorescences shown in Fig. 1.

| Number of eggs | Number of inflorescences | |
|---|---|---|
| | No open flowers | Open flowers |
| 0 | 43 | 120 |
| 1 | 53 | 8 |
| 2 | 14 | 2 |
| 3 | 9 | 0 |
| 4 | 3 | 0 |
| 5 | 1 | 0 |
| 6 | 1 | 0 |
| 7 | 0 | 0 |
| 8 | 1 | 0 |

(presumably last instar). Most larvae, however, were intermediate in size. Clearly, further damage would have been done if the inflorescences had been permitted to progress to seed set. We feel, however, that such damage would have been relatively minor since the ovaries were all well developed and were subject to little attack.

Eight inflorescences were destroyed in the course of the study, leaving 41 controls and 51 exposed to attack. A total of 111 eggs were laid on the exposed inflorescences, 2.18 per inflorescence. The 41 control inflorescences had a potential production of 967 mature flowers. This group actually produced 693, or 71.66 percent of potential. The experimental group had a potential production of 1433 mature flowers and actually produced 533, or 37.19 percent of potential. Of these mature flowers 138 were so badly damaged that they would have abscissed without setting seed, so that a more realistic estimate of realized potential in the experimental group is 395/1433, or 27.56 percent. Both experimental groups (with and without damage) are, of course, highly significantly different from the controls ($P \ll .01$).

A sample of 100 large inflorescences was taken on 15 July from the Crested Butte population of *L. amplus* on which *G. lygdamus* is rarely seen. This population of lupines is essentially continuous with that at Gothic, some 5 miles (8 km) away. Of a potential of 4169 flowers, 3149 (75.53 percent) were realized, and 3091 (74.14 percent) were judged sufficiently undamaged to set seed. Only 11 egg shells or larvae were found on these plants. In contrast, an additional sample of 100 large inflorescences from the Gothic population, where *G. lygdamus* was abundant, was censused on 16 July. Of a potential of 4277 flowers, 2434 (57.31 percent) matured. Of these 2152 (50.67 percent) matured and were judged sufficiently undamaged to set seed. On these inflorescences 126 *G. lygdamus* egg shells or larvae were found. The differences between the two areas are highly significant ($P \ll .01$).

The damage done to the Gothic population of *L. amplus* by this small butterfly is stunning. In 1968 nearly 50 percent of the potential seed production was destroyed by *G. lygdamus*, which has been abundant at Gothic in every season since 1960 except 1964–65 (when no observations were made). There is no reason to believe that the 1968 density was unusual. Presumably the lupines have been subject to a long-term attrition of their seed production. This has a drastic selective effect on the plant population. Lupines are dependent on having an abundance of seeds widely distributed in the soil since they germinate only upon disturbance and scarification.

We can guess at one selective response of the plant to *Glaucopsyche* attack—advancement of flowering time. The Gothic population of *L. amplus* seems to have been pushed to its earliest limit, as many examples of frost-killed and damaged inflorescences were observed this year. The butterflies oviposit strictly on the immature inflorescences (Table 1), indicating that plants on which flowers mature before the adult butterflies emerge, or early in the flight season, would be least subject to damage. There is no other obvious reason for the early flowering, as seed production is completed with more than a month of growing season remaining. At this time, other explanations cannot be excluded.

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# C′3 Synthesis in the Human Fetus and Lack of Transplacental Passage

Abstract. *Allotypic differences in the third component of complement between mothers and their newborns provided evidence for synthesis of this complement component by the fetus. There was no indication that this protein traversed the placenta. The known low level of C′3 in the neonate was confirmed, and the maternal concentration was found to be significantly elevated.*

The third component of complement, C′3 or $\beta_{1c}$-globulin, has been shown to be present in human fetal blood as early as 9 weeks of age (*1*), but it is not known whether the protein is synthesized by the mother or the fetus. The demonstration of differences in phenotype between the mother's and her newborn's plasma proteins has provided evidence for human fetal synthesis of haptoglobin (*2*), transferrin (*3*), and Gc-globulin (*4*). With the recognition of genetically controlled polymorphism in C′3 (*5*), it has become possible to examine in similar fashion the question of fetal synthesis and transplacental passage of C′3 in man.

The C′3 polymorphic system in man is composed of two common codominant alleles, designated F (fast) and S (slow). Approximately 97 percent of 200 people typed to date are either FF, FS, or SS. In the remaining 3 percent, certain rare alleles have been found. We have named the rare allotypes by their positions relative to the S allotype. The fastest and slowest rare allotypes thus far detected are $F_1$ and $S_1$, and we have found three other rare allotypes similarly named $F_{0.8}$, $F_{0.5}$, and $S_{0.6}$ (Fig. 1).

Typing of C′3 was performed on 25 maternal and cord paired serums. Samples were stored for a maximum of 24 hours at 4°C before analysis by prolonged agarose electrophoresis. Total