Entomologic Appraisal of Fly Control Programs

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The effectiveness of vector control operations can best be determined by measuring the extent to which the prevalence of the vector has been reduced. While the effect of this vector reduction also is reflected in the incidence of the disease concerned, the latter may frequently be influenced by other factors (such as disease cycles, medication, and method of reporting) to such a degree that it cannot serve for a critical appraisal of the efficacy of vector control operations. For example, in certain areas of the United States malaria has ceased to be a problem even though the vector still persists in abundance. Furthermore, suitable routine facilities to detect disease trends are not always available. Consequently, the criterion selected for determining the adequacy of an insect control program must basically relate to the density of the vector.

On present-day fly control programs, the evaluation of the effectiveness of the suppressive measures is confined largely to measuring the fluctuations of adult fly densities. The incidence of diseases (e.g. Shigellosis) transmitted by these insects is not readily discernible by the routine diagnostic and reporting practices of physicians. In addition, many fly control programs are established on a nuisance relief basis, or upon the supposition that certain diseases or detrimental conditions arise from the fly population.

Since measurement of fly densities forms not only the foundation of appraising control effectiveness but also serves to guide the type, frequency, and placement of the suppressive measures, it seems inconceivable that there would be any question as to the need for such evaluation. The basis for this questioning attitude probably lies in the complete but erroneous reliance of the public on the suppressive action of the newer insecticides. In accordance with this belief, the chemical once applied as a blanket treatment should yield a definite period of effectiveness, followed by as many applications as are necessary to extend the control for the time desired. On this premise, evaluation possibly could be dispensed with as an unnecessary expenditure. However, control of any insect, particularly those with short reproductive cycles, rarely lends itself to control by rote. Further, routine nonselective control operations are much more costly than selective measures. Consequently, effective fly abatement depends upon adequate evaluation, supported by the judicious application of suitable control measures.

The principal technique of evaluating fly control programs or measures concerns measurement of adult densities. Larval prevalence is unreliable, not only from the lack of suitable quantitative criterion, but also because of the difficulties of accurate field identification. With adult flies, however, a number of devices and techniques can be employed to yield reliable quantitative findings, and the qualitative determinations are not too difficult to make. Regardless of methods employed, several basic principles must be followed in making the necessary observations:

1. The same technique should be employed for each successive appraisal.
2. The size of the sample must be adequate to represent the area under surveillance.
3. Observations should be on a routine basis at intervals of 2 weeks or less.
4. Successive periodic surveys should be so scheduled as to minimize the effects of ecologic factors upon the results secured.

By adherence to these fundamentals, it makes little difference as to which of the various techniques is employed. Simple observation in a dairy farm of the number of flies alighting on a square of blotting paper soaked in milk will provide data comparable in significance to those obtained by means of trap or grill. Preference of one method or another is largely contingent upon the local situation as regards manpower, area of surveillance, and the degree of accuracy desired in the ultimate results.

Among the various methods of evaluating fly populations are the fly trap, Scudder grill, reconnaissance or visual survey, baits, and tapes. Each of these when properly employed can yield a

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density index which can be compared with other indices similarly derived. All techniques measure the density of only a portion of the fly populations, the relationship of this portion to the total fly density in a given area being undetermined. However, the presumption can be made that the portion appraised remains relatively fixed, thereby permitting accurate collection of data from successive appraisals.

For small areas such as dumps, rendering plants, dairy barns, and the like, measurement of fly densities is simplified to the extent that the limited area of surveillance makes it possible to sample designated stations in a routine manner, week after week. This fact eliminates or minimizes many of the variables of environmental fluctuations, and also permits a larger number of observations, thus augmenting the reliability of the data secured. At the same time, detection of breeding sites and their subsequent elimination, or the control of breeding therein, is rendered less difficult because of the small area involved.

It is in the evaluation of large-scale fly control activities such as community programs that the sample size, techniques employed, and inspection schedule assume far greater significance. Because of the more extensive area concerned, the elements of time and manpower become increasingly important. Essentially the entomologic surveillance can be subdivided into two major functions:

1. Measurement of adult prevalence and detection of breeding sites to guide the individual control operations.
2. Measurement of adult prevalence to determine the over-all effectiveness of the control measures applied.

To fulfill the first function, visual observation or reconnaissance will suffice. No detailed method of fly measurement, such as the trap or grill technique, is required to appraise the immediate effect of space spray application; the answer to this can be provided by a rapid survey over the block or premises to note the abundance of flies. The crude data thus obtained are adequate to demonstrate whether further effort is needed. Search for the breeding foci again demands the visual method, this necessitating much more intensive coverage than the adult survey and being dependent for its success upon the experience and diligence of the inspector. The pattern of these evaluative operations is fluid, being governed by the conditions as they exist from day to day.

The second function of appraising the over-all effectiveness of the control program differs from the first in that it measures the trends in fly densities from week to week, and is not concerned with the every day minutiae of guiding the suppressive tactics, even though data so derived can also be employed for that purpose. Of the various methods utilized for this type of appraisal, the Scudder grill technique (figure 1) has been the recommended and most widely used procedure. Fly traps, although useful in quantitative surveys, serve chiefly as qualitative indicators. From the evidence available, it seems apparent that the merits of the trap as a quantitative indicator have not been sufficiently explored to determine its value in this category.

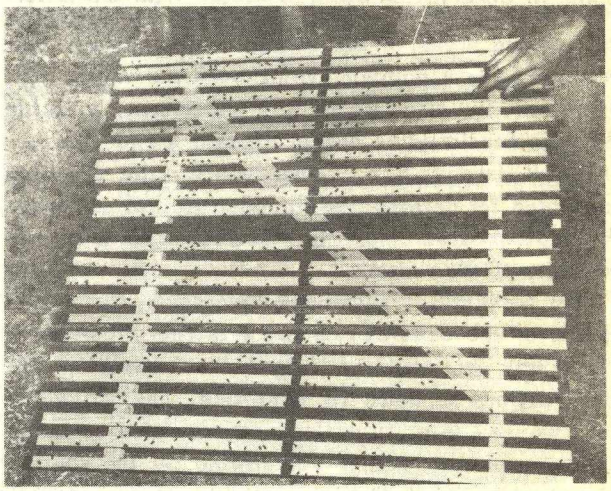


Figure 1. Measurement of fly densities by Scudder grill technique.

Reconnaissance surveys, probably the oldest of these three methods, recently have received increased attention because of the rapidity with which they can be conducted, together with the realization that visual estimates of fly densities are not as grossly inaccurate as originally believed.

In special comparative tests of the grill and reconnaissance techniques, inspectors trained in use of the grill conducted both types of surveys in selected blocks. On the reconnaissance observations, the inspector noted the fly concentration and then estimated the number of flies that would alight on a grill had this device been placed over the attractant. Preliminary analyses of data from these tests reveal that in areas having block ratings of below 40 flies per grill count, density levels with the Scudder grill generally exceeded those obtained by visually making estimated grill

counts. This difference usually decreased as the level of fly prevalence dropped, block ratings obtained by both methods frequently being on par with each other. Population trends also showed similar parallel fluctuations with the two techniques. As these observations were made by experienced grill inspectors, the results might not have been so comparable using less highly trained personnel. However, the data do indicate that the reconnissance survey can serve as a useful evaluative tool to provide comparative measurements of fly densities. Reliance on the reconnaissance method places greater dependence upon the inspector's integrity, and removes the advantage of counting and identifying the flies on a single plane of observation such as occurs with the grill.

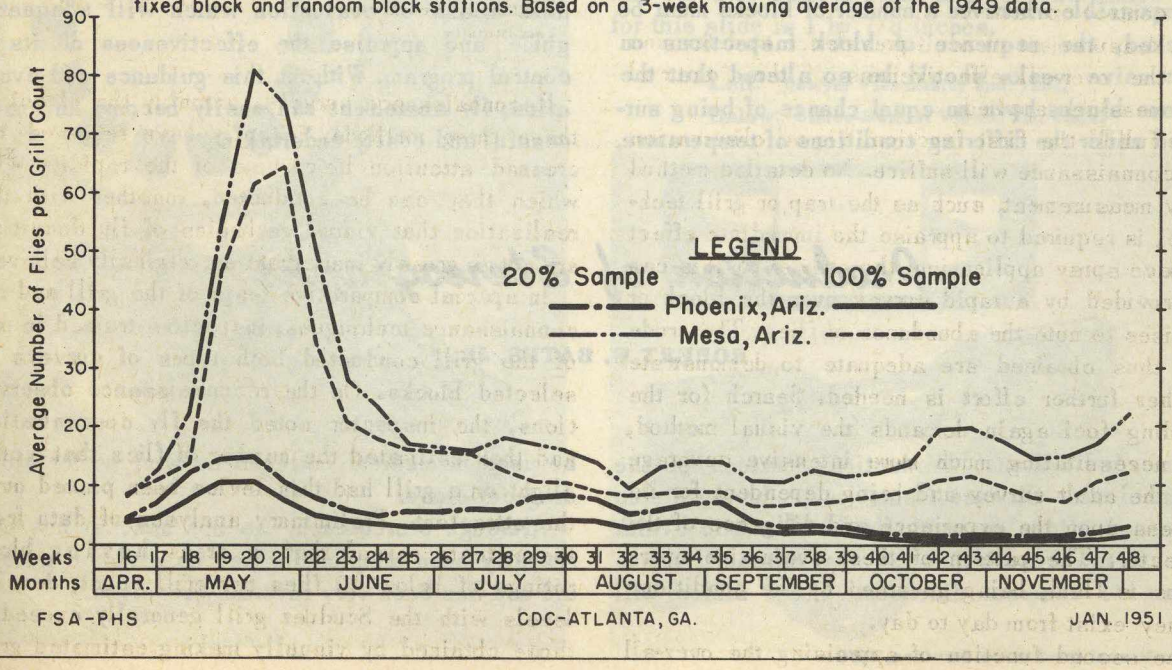
The chief virtue of this method over grill surveillance is that the rapidity with which it can be conducted enables a reduction to be effected in manpower requirements or (with the same inspection force) permits an increase in the sample size.

On the assumption that a suitable means of measuring fly densities is being used, the next step is the selection of an adequate sampling pattern. Theoretically, examination of all blocks on a weekly basis achieves the ideal; however, such intensive coverage is too expensive for practical purposes, and at the same time is unnecessary, since a smaller sample can provide ample data for measuring population trends. As shown in figure 2, the relative fluctuations of fly densities derived from 100 percent and 20 percent samples in the same area approach similarity in reflecting trends in treated and untreated towns. The magnitude of densities with the smaller sample is greater, as would be expected, since the small sample selected on basis of blocks of high fly potential lacks the dilution factor caused in the larger samples by inspection of numerous blocks of low fly prevalence. Likewise, the peaking effects of the small samples are more abrupt.

Of equal importance to sample size is the manner of selecting the sample units, the significance of this aspect increasing in inverse proportion to the sample size. Much debate has revolved around the question. Some favor division of the community into units or zones (10 to 20 blocks each), letting one block in each serve as an index to fly prevalence in the unit; others advocate a similar arrangement, except that the identity of blocks inspected changes from week to week. A third approach is to use large units (70 to 400 blocks) and to cover the majority of the blocks of the high potential routinely, inspecting the remainder on

Figure 2

A comparison of the trends in fly densities in the business sections of Phoenix, Ariz. (treated), and Mesa, Ariz. (untreated), when derived from a 100 percent grill coverage of all city blocks, and when based on a 20 percent sample of fixed block and random block stations. Based on a 3-week moving average of the 1949 data.



biweekly, monthly, or less frequent schedules. Present CDC programs use a combination of the first two procedures, whereby two blocks in each unit are sampled weekly by the grill method, one being a fixed station block representing the block with the highest fly potential in the area; the other, the random block station changing from week to week. Results indicate this technique to be entirely satisfactory for reflecting population trends in the large metropolitan areas where these activities were undertaken.

Probably the defect most evident on surveillance programs is the inability to establish and maintain inspections on routine weekly or semiweekly schedules. One reason behind this inability is the general tendency to adopt an inspection schedule too extensive for the manpower available. This invariably results in insufficient data collected in a discontinuous manner. Such data rarely lend themselves to accurate interpretation. Schedules arranged to expend 80 percent of the allotted time in completing the required inspections generally provide ample compensation for time loss arising from adverse weather conditions. Continuous data derived from smaller samples is to be preferred to those procured from sporadic inspections of a more extensive sampling area.

The pattern of fly activity being contingent upon the various ecological factors of the environment makes it advisable to conduct surveys under conditions as nearly similar as possible. As performance of block surveys over the same time intervals is impossible wherever a number of blocks must be checked, the sequence of block inspections on successive weeks should be so altered that the various blocks have an equal chance of being surveyed under the differing conditions of temperature, moisture, and shade.

In any community program, the scarcity of flies can be due either to unfavorable weather conditions or to the control measures employed or to both. To ascertain more closely the role control operations play, it is essential that some effort be made to determine fly densities in an area where conditions are similar to the treated city except for the absence of control tactics. An untreated town selected for this purpose rarely shows identical sanitation conditions, and the fly densities may exceed or be less than those in the treated city. However, the data secured will yield an appraisal of the trends in the fly population which can serve as a yardstick for those obtained in the treated city.

Community fly programs vary in scope from those of a purely operational nature to those established for research purposes, and in size from hamlets of 500 to 1,000 people to municipalities in the range of 50,000 to 100,000 population. With such diversity of purpose and size, the funds, manpower, and objectives likewise exhibit much variation, which in turn is translated into modifications of control and evaluative procedures. The extensive coverages desirable in the larger cities are not necessary in the smaller communities; the reconnaissance survey adequate for a small operational program may lack the degree of accuracy required on a research endeavor. Consequently, both control and appraisal efforts must of necessity be fluid and adaptable to local conditions. By this approach it is felt that any community can establish a suitable means of evaluation which will adequately guide and appraise the effectiveness of its fly control program. Without this guidance and evaluation, fly abatement can easily become an unsuccessful and costly undertaking.

Production of Stereographs

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The Audio-Visual Production Services of the Communicable Disease Center is producing stereo reels and slides in many fields of public health work. At the present time the most advanced series pertain to venereal diseases. These slides will be used in medical colleges as well as for aiding diagnosticians.

Although stereography is not new, it has only recently been adapted for use as a visual training aid and has been very favorably received.

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