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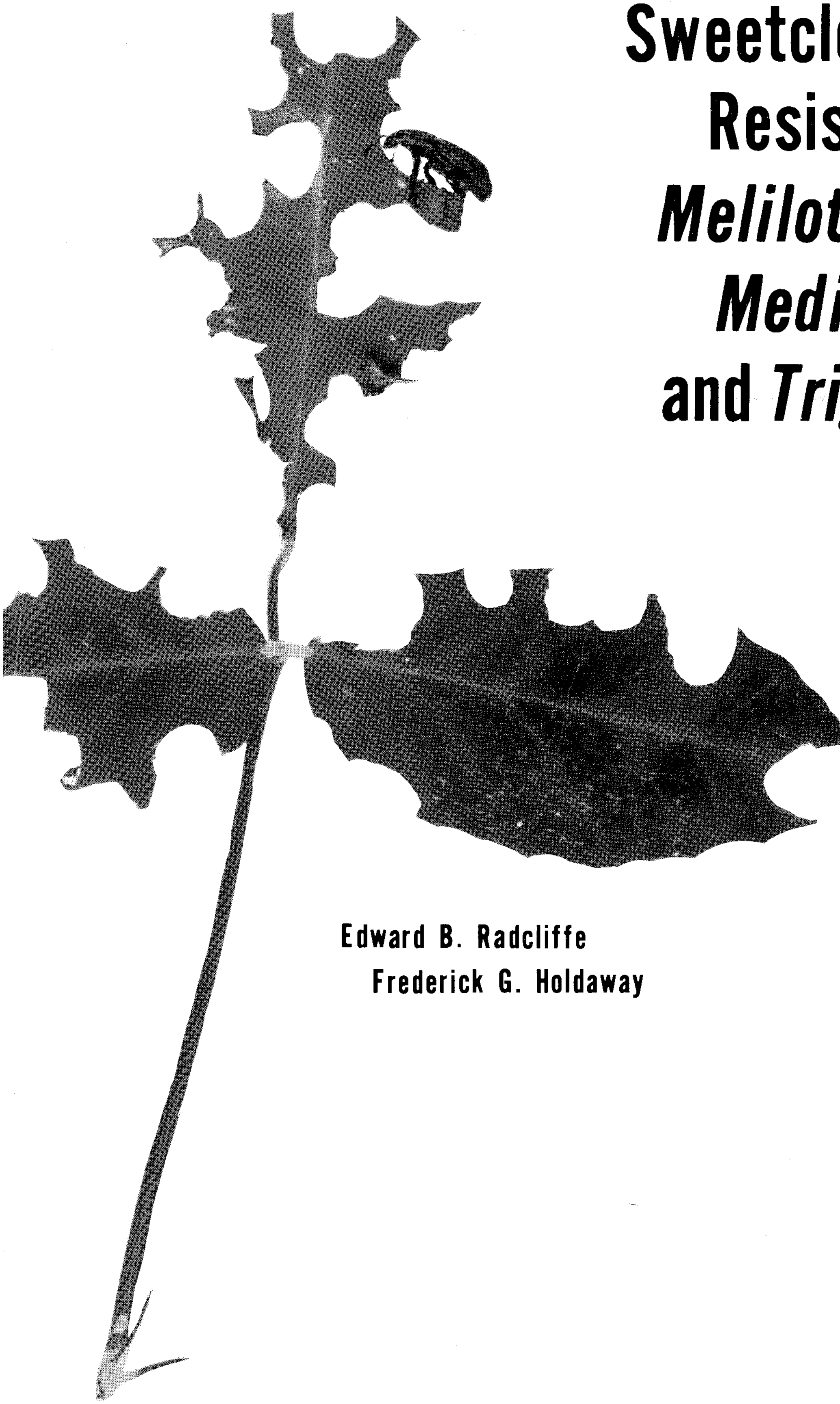

Sweetclover Weevil Resistance in *Melilotus* Adans., *Medicago* L., and *Trigonella* L.

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Sweetclover Weevil Resistance in *Melilotus* Adans., *Medicago* L., and *Trigonella* L.

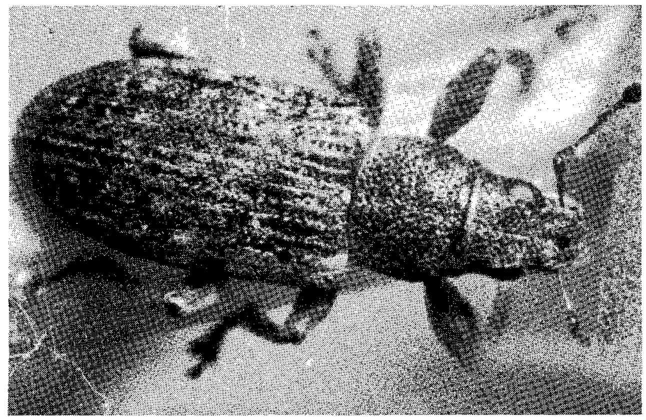
Edward B. Radcliffe and Frederick G. Holdaway[*]

The sweetclover weevil, *Sitona cylindricollis* Fåhraeus, is regarded as a limiting factor in the culture of sweetclover—*Melilotus alba* Desr., white sweetclover, and *M. officinalis* (L.) Lam., yellow sweetclover—in the United States and Canada (1, 2, 28).[1] Chemical control of the weevil is practical (7), but the use of insecticides on this crop has gained little acceptance. In Minnesota, sweetclover has its greatest potential value as a plow down crop in sugarbeet rotations. Because most Minnesota growers are reluctant to invest in insecticides for a green manure crop or to risk possible insecticide residues in the succeeding beet crop, the use of sweetclover has declined in favor of alfalfa, *Medicago sativa* L., or an alfalfa-sweetclover mix.

Although alfalfa is a host of the weevil, it is seldom attacked severely enough to occasion economic losses. Complete destruction of sweetclover stands over large areas has often been reported (13). However, sweetclover is unexcelled as a source of humus and organic nitrogen. In the seeding year, sweetclover protected from weevil injury may yield twice the organic matter and three times the nitrogen of alfalfa (24). In the second season, a good sweetclover crop yields more than 100 pounds of nitrogen (11). Moreover, the taproot of sweetclover penetrates the subsoil, increasing soil aeration and improving internal drainage better than any other legume (26).

Some effective nonchemical means of controlling the sweetclover weevil must be found before sweetclover acreages are likely to increase. Such an approach would be the development of sweetclover varieties resistant to sweetclover weevil injury. This bulletin describes the authors' search for sources of weevil resistance in sweetclover and two closely related plant genera.

Bird (1), the first investigator to report differential weevil injury to various sweetclover varieties, found that Hubam, Erector, and Common White were the most resistant varieties he tested. Munro et al. (15) observed differences in the susceptibility of 15 sweetclover varieties and found that Grundy County was the most resistant followed by Melana, Erector, and Evergreen. Haws (6) and Wilson et al. (28) reported that Common White and Common Yellow sustained



The sweetclover weevil

less injury than any other sweetclovers they screened. Spanish and Erector were the most resistant of the named varieties. None of the varieties tested in these studies was sufficiently weevil resistant to prevent crop losses.

Connin et al. (3) developed improved laboratory procedures for evaluating preferential feeding by the sweetclover weevil on diverse varieties and species of *Melilotus* Adans. Furthering Connin's study, Manglitz and Gorz (14) surveyed host ranges for both the sweetclover weevil and the sweetclover aphid under greenhouse conditions. They surveyed all recognized species of *Melilotus* except *M. bicolor* Boiss. and Bal. *M. bicolor* is known only by herbarium specimens and is assumed to belong in the genus *Trigonella* L. (25). Manglitz and Gorz (14) also determined the feeding response of the sweetclover weevil to representative accessions of 19 species of *Trigonella* and three other legumes. Only one sweetclover species, *M. infesta* Guss., Bdn. 61-98, was not fed upon by the sweetclover weevil.[2]

In an extensive field screening program (unpublished data obtained during 1951-64 on 3,238 accessions), Gross and Stevenson (5) observed that one species, *M. infesta*, represented by two accessions, Bdn. 61-98 and 62-9, was immune to weevil attack. Radcliffe and Holdaway (17) reported that *M. infesta* accessions P.I. 208685, Bdn. 61-98, and Bdn. 62-9 were

[*] Edward B. Radcliffe is an assistant professor and the late Frederick G. Holdaway was a professor in the Department of Entomology, Fisheries, and Wildlife, University of Minnesota.

[1] Numbers in parentheses refer to literature citations on page 26.

[2] Entries designated by the prefix Bdn. were supplied by G. A. Stevenson and A. T. H. Gross, Canada Department of Agriculture, Brandon, Manitoba.

highly resistant in Minnesota trials.[3] Unlike the previous workers, Radcliffe and Holdaway (17, 18) did not find *M. infesta* to be immune to weevil feeding. However, *M. infesta* was appreciably more resistant than any other sweetclover species they surveyed.

The survival and fecundity of overwintered weevils confined on seedlings of various sweetclover species and Ranger alfalfa were compared by Hedlin and Radcliffe (9). Twenty females caged on *M. sulcata* Desf., P.I. 202512, failed to produce any eggs; 20 females confined on *M. infesta,* Bdn. 61-98, laid only 25. Egg production of weevils confined on 10 other accessions ranged from 305 on *M. dentata* (W. & K.) Pers., P.I. 260271, to 1,954 on *M. suaveolens* Ldb., P.I. 260271. The 20 female weevils caged on Ranger alfalfa produced 435 eggs.

Field surveys of wild sweetclovers for weevil resistance were reported previously (5, 17, 18, 20), but the present study is the first to identify specifically all accessions screened and to present a statistical analysis of data obtained. This report also is apparently the first on field performance of the closely related plant genera *Trigonella* and *Medicago* with respect to sweetclover weevil resistance. Additional data obtained in laboratory experiments on host preferences are also presented.

Classification of the Sweetclovers

Sweetclover belongs to the clover tribe Trifolieae Bronn., family Leguminosae Endl. Its closest taxonomic affinities are with *Trigonella* and *Medicago* (25). All three plant genera include species which may serve as hosts of the sweetclover weevil but immune species occur within *Trigonella* and *Medicago*. Manglitz and Gorz (14) suggested that the weevil resistance inherent in *M. infesta* may have arisen from some previous interchange of germ plasm between *Melilotus* and *Trigonella*.

Since Schulz (19) published his monograph on *Melilotus,* most authors have regarded the sweetclovers as belonging to two distinct subgenera, the typically annual *Micromelilotus* Schulz and the typically biennial *Eumelilotus* Schulz. Substantial modifications in the classification of this group recently were proposed by Suvorov (25). He argued that sweetclovers belong to three distinct subgenera differing in genesis, geographic derivation, and noncrossability as follows.

1. The Asiatic sweetclovers, subgenus *Eumelilotus* Suv. (Schulz), are comprised of four species: *M. alba, M. officinalis, M. suaveolens,* and *M. dentata.* These species probably arose in the eastern part of the Miocene Mediterranean in the mountainous zone of the Tien Shan. The Asiatic species are characteristically biennial, tall, late maturing, and of high adaptive vitality.

2. The Mediterranean sweetclovers, subgenus *Micromelilotus* Suv. (Schulz), are products of the mild coastal areas of southern Europe. This genus is comprised of eight species: *M. italica* (L.) Lam., *M. sulcata* in which Suvorov included *M. infesta* and *M. macrocarpa* Coss. and Dur., *M. segetalis* (Brot.) Ser., *M. indica* (L.) All., *M. neapolitana* Ten. in which Suvorov included *M. elegans* Salzm., *M. messanensis* (L.) All., *M. speciosa* Dur., and *M. taurica* (M.B.) Ser. Most other researchers (12, 19, 23) placed *M. taurica* in the subgenus *Eumelilotus.* With the exception of *M. indica,* the *Micromelilotus* have limited geographic distributions. *M. taurica* is a biennial; all other *Micromelilotus* are small, short-lived annuals. The Mediterranean sweetclovers are characterized by great ecological conservatism. Of all the present sweetclover species, Suvorov assumed that *M. italica* may most closely resemble the ancestoral type.

3. The Caspian sweetclovers, subgenus *Macromelilotus* Suv. are of four species: *M. polonica* (L.) Desr. (= *M. caspius* Gruner), *M. wolgica* Poir., *M. hirsuta* Lipsky, and *M. altissima* Thuill. Other researchers (12, 19, 23) placed these four species in the subgenus *Eumelilotus.*

Suvorov (25) regarded the *Macromelilotus* as the most recently evolved subgenus, possibly having arisen from hybridization between species of the two older subgenera. The Caspian sweetclovers are the most rapidly evolving group. All *Macromelilotus* are tall, bushy biennials restricted to the lower Volga.

Materials

Viable interspecific hybrids are not readily obtained from crosses within the genus *Melilotus* and have never been successfully accomplished between the typically biennial *Eumelilotus* and the typically annual *Micromelilotus* (23). Therefore, an extensive sampling of *M. alba* (195 entries) and *M. officinalis* (222 entries) accessions was surveyed in the study. To assess the potential weevil resistance within the germ plasm of the genus *Melilotus,* representative introductions of all available sweetclover species also were surveyed. *M. bicolor* was the only sweetclover not included in the trials but another, *M. polonica,* was tested only in the laboratory. The host range of the sweetclover weevil was further defined by inclusion of various species introductions of *Trigonella* and *Medicago* in the field trials.

In this report, observations on various sweetclover species are discussed under the three subgeneric groupings proposed by Suvorov (25). *M. elegans, M.*

[3] Entries designated by the prefix P.I. were supplied by the North Central Plant Introduction Station, Ames, Iowa, and the Southern Plant Introduction Station, Experiment, Georgia.

infesta, and *M. macrocarpa* are accepted here as distinct and valid species. The various accessions surveyed are identified by the species name and code designation employed at their source.

Field data were obtained on the relative weevil resistance of 523 *Melilotus* accessions, 37 *Medicagos,* and 35 *Trigonellas.* Some of these introductions were included in several years' trials; 20 *Melilotus* accessions were in all 4 years' experiments (table 1). As shown in table 2, data were obtained on 175 accessions in 1963, 206 in 1964, 141 in 1965, and 187 in 1966. Eighteen species of *Melilotus,* all of the recognized species except *M. polonica* and *M. bicolor* (12), 21 species of *Medicago,* and 14 species of *Trigonella* were surveyed in field trials.

Laboratory studies were conducted in 1964-65 to obtain information on host preferences of the sweetclover weevil. In these experiments, 67 *Melilotus* accessions, representing all the known species except *M. bicolor,* and two commercial alfalfa varieties were tested.

Field Studies of Sweetclover Weevil Resistance

Experimental Methods

The field studies reported here were conducted under natural weevil infestation near Crookston, Minnesota, from 1963 to 1966. Each year the experimental plots were seeded on fallowed land bordered by 2nd-year sweetclover. Plots were seeded May 8, 1963; May 15, 1964; May 19, 1965; and May 28, 1966.

Each plot consisted of a single row 8 meters long; the row spacing was 0.3 meter. A completely randomized four replicate design was used. Rows were arranged in a single tier, each row originating at the margin of the established stand. This plot design resulted in a comparatively uniform infestation of adult weevils over the experimental area. The plots were hand weeded until evaluated.

The sweetclover weevil overwinters as an adult; this population declines as the season progresses and is virtually eliminated by mid-July. Late-seeded sweetclover presumably would escape much of the injury caused by this generation of weevils. Since the sweetclover weevil cannot fly until it has overwintered, summer emergents cause losses only if the new seeding is adjacent to an established stand (7). Early plowing of established stands before the new generation emerges effectively reduces the population. At Crookston the summer emergents appear in mid-July.

Each year the data on sweetclover weevil resistance were recorded approximately 7 weeks after the date of planting. The data obtained were estimates of the defoliation caused by the weevils. The evaluators formed their impressions of the mean level of injury to each accession while slowly walking along the rows examining the plants. Injury rating diagrams, identical to those described by Radcliffe and Holdaway (17), were reproduced on each tally sheet so that evaluations could be made according to predetermined standards. These diagrams showed leaflets with 10 degrees of injury ranging from 0 to 90 percent defoliation. By interpolation the injury was estimated to the nearest 5 percent defoliation.

In 1963, two persons made evaluations; in succeeding years, three persons contributed data. For consistency, these evaluators compared their observations immediately after recording their ratings. Approximately two-thirds of the individual evaluations were within ± 5 percent of the mean rating given to that entry.

Most plots consisted of from 10 to 150 plants. A few accessions, particularly some *Micromelilotus,* had sparse stands due to poor germination. No data are presented in this report for any entry which was not represented by at least one plant in each replicate.

Statistical Methods

The data obtained for the 20 *Melilotus* introductions common to all 4 years were used to calculate adjusted mean injury levels (table 1) by use of the Patterson method (16). This method permitted direct comparison of data obtained in different years and locations (table 2). The three principal advantages of this procedure were: (1) differences between varieties grown during the same period at a given location were not changed by the adjustment, (2) the accession-year interaction present in the data was not disturbed by the adjustment, and (3) it was not necessary to estimate or calculate the performance of an accession for any year it was not tested.

The principal disadvantage of the Patterson method was that the adjusted means could fall outside the 0 to 100-percent range. Adjustments for environmental effects may substantially alter the ratings of immune or highly resistant accessions. In 1965, for example, many apparently immune accessions of *Trigonella* and *Medicago* were identified, but these accessions had an adjusted mean of 22 (table 2). This situation occurred because an environmental effect of −21.5 was calculated from that year's data.

In table 2, data obtained for each accession are presented by species and are ranked according to the adjusted means from the most resistant to the most susceptible. To each year's data, Duncan's New Multiple Range Test was applied at the 5-percent level of significance. The lowest recorded mean percentage defoliation not significantly different from the mean injury to that accession is indicated in table 2 by the number in parentheses.

Sweetclover Weevil Resistance in the *Micromelilotus*

The sweetclover species possessing the greatest level of resistance to the sweetclover weevil was *M. infesta*. In the 1963 experiments, an accession identified as *M. segetalis*, P.I. 208685, proved much less susceptible to weevil injury (18 percent defoliation) than any other entry evaluated (17, 18). Because all other *M. segetalis* entries proved so much more susceptible, plants of this accession were sent to G. A. Stevenson for identification. He determined that these plants were of the species *M. infesta*.

Because of limited seed and poor germination, only three replicate's data on this entry were obtained in both 1963 and 1965. Therefore, in this report, only 1964 data are presented for this accession (table 2). Two additional *M. infesta* accessions, Bdn. 61-98 and Bdn. 62-9, were also evaluated in 1964. All three *M. infesta* entries evaluated that year were highly resistant (5 to 8 percent defoliation). In the 1965 experiments, both *M. infesta* accessions, Bdn. 61-98 and P.I. 208685, were significantly more susceptible than several *M. sulcata* entries (table 2).

The *M. sulcata* accessions elicited considerable variation in weevil reaction (table 2). The range of adjusted means for this species was from 15 to 41 percent defoliation. Certain entries, notably Bdn. 61-31, P.I. 202512, and Minn. 85 (probably identical with P.I. 202512), were consistently rated as highly resistant.[4] The most resistant accessions of *M. sulcata* approached the resistance of *M. infesta* and sustained approximately one-third the injury caused to commercial varieties of *M. alba* and *M. officinalis*.

Most *M. segetalis* accessions and the single entry of *M. macrocarpa*, Bdn. 61-97, were as susceptible to weevil injury as were the commercial sweetclovers (table 2). The injury range of adjusted means was from 34 to 43 percent defoliation for *M. segetalis* and 42 percent for the *M. macrocarpa* accession. These data are of interest because Suvorov (25) stated that *M. macrocarpa* and *M. infesta* are synonyms for *M. sulcata*. Most researchers (12, 19) regard *M. macrocarpa* as quite distinct from *M. sulcata*.

According to Isely (12), *M. sulcata, M. infesta,* and *M. segetalis* form an intergrading series, with *M. sulcata* and *M. infesta* constituting the extremes and *M. segetalis* as a heterogeneous series of intermediates. Many plants display a mixture of *sulcata-segetalis* or *segetalis-infesta* characteristics and can be identified only in a subjective manner. Morphologically, *M. infesta* appears very similar to *M. segetalis* as stated by Isely (12), but the similar host reaction elicited from the sweetclover weevil by both may support Suvorov's (25) contention.

None of the *M. messanensis* accessions tested possessed the high resistance characteristic of the closely allied *M. sulcata*. The adjusted means for *M. messanensis* ranged from 36 to 42 percent defoliation. Thick, fleshy cotyledons are characteristic of the series Campylorytis Ser. of Schulz (19): *M. infesta, M. sulcata, M. segetalis,* and *M. messanensis*. Cotyledons of this type apparently are not fed upon by the sweetclover weevil. Perhaps the cotyledons are too thick for the insect to close its mandibles about them.

M. italica was the most difficult species to evaluate because of its unusual, large, orbiculate leaves. However, *M. italica* was fed upon readily. The adjusted means for this species ranged from 40 to 47 percent defoliation.

M. speciosa was represented in the experiments by only one entry, Bdn. 536. That entry was relatively susceptible, 47 percent defoliation, to weevil injury.

M. indica, sour sweetclover, invariably suffered severe weevil injury in these trials. The adjusted means ranged from 49 to 64 percent defoliation. This species, the shortest-lived sweetclover, flowers as early as 6 weeks after planting in Minnesota and seldom attains a height of more than a few inches. The short duration of the vegetative phase does not permit this species to outgrow the weevil injury. The relatively high injury ratings given the *M. indica* accessions may be due more to its growth characteristics than to preferential selection by weevils. *M. indica* is widely distributed as an agricultural crop in subtropical climates (11) but will not overwinter in the north central states.

M. taurica possessed an intermediate level of resistance; the adjusted means ranged from 25 to 35 percent defoliation. *M. taurica* had poor vigor and was frequently diseased with a mosaic virus. The species is a biennial and overwintered in the plots although it is only indigenous to southern Crimea.

Sweetclover Weevil Resistance in the *Eumelilotus*

Within both *M. alba* and *M. officinalis,* the most resistant accessions sustained about 60 percent as much defoliation as the most susceptible entries. The adjusted means ranged from 34 to 56 percent defoliation for *M. alba* and from 37 to 61 percent for *M. officinalis*. Characteristically, *M. alba* was slightly less susceptible (adjusted mean 43.5 percent defoliation) than *M. officinalis* (49.5 percent defoliation).

Of the over 400 accessions of these two species surveyed, none possessed resistance of agronomic significance. Within both species, statistically significant differences in injury level were observed. The low levels of resistance inherent in certain accessions

[4] Entries designated by the prefix Minn. were of uncertain origin.

possibly could be intensified by selection and inbreeding. Alternatively, the extensive screening of large plant populations subjected to massive weevil infestation might result in the discovery of individual plants possessing resistance.

M. alba and *M. officinalis* are vigorous and well adapted species. This vigor, particularly characteristic of the commercial varieties, makes these accessions tolerant of even severe defoliation. Less vigorous species such as *M. indica* suffer high mortality. Differences in tolerance were especially apparent in 1963 when the most severe defoliation occurred.

The named sweetclover varieties did not differ appreciably from the wild accessions in either the range or mean levels of weevil injury. The 11 commercial selections of *M. alba* had adjusted means ranging from 38 to 51 percent defoliation and an average injury of 44.9 percent. The eight commercial selections of *M. officinalis* had a range of adjusted means from 43 to 50 percent defoliation. Their average injury was 46.3 percent.

A seed lot of *M. alba* from Austria, referred to here as Austrian White, was the most resistant commercial sweetclover. On the basis of the adjusted mean injury ratings, the commercial varieties surveyed may be ranked as follows: Austrian White, 39 percent; Hubam, 40 percent; Arctic, Brandon Dwarf, and Denta, 42 percent; Goldtop (two entries), 43 and 50 percent; a white diploid annual from Germany, 44 percent; A-46 and Common Yellow, 45 percent; Erector (two entries), 46 and 48 percent; Madrid and S-65, 46 percent; Evergreen, 47 percent; Cumino and Spanish, 49 percent; Israel, 50 percent; and Alpha, 51 percent.

M. dentata possessed a level of resistance intermediate between that of *M. sulcata* and the agriculturally important biennial species, *M. alba* and *M. officinalis*. The adjusted means calculated for *M. dentata* ranged from 29 to 39 percent defoliation. *M. dentata* is perhaps the most interesting possibility of potential sources of weevil resistance within the *Melilotus* because it is in the same subgenus as our commercial sweetclovers.

The low coumarin content characteristic of *M. dentata* was transferred to *M. alba* by Smith (21), making possible the development of coumarin-free *M. alba* varieties such as Cumino (4) and Denta (22). Hybrids of this cross were chlorophyll-deficient and had to be reared to maturity by being grafted onto normal sweetclover plants.

M. dentata has not been crossed with *M. officinalis;* these species appear completely incompatible (27). By means of embryo culture, viable hybrids between *M. alba* and *M. officinalis* have been produced (27). *M. alba* possibly could serve as a bridge to transfer some desirable characteristics from *M. dentata* to *M. officinalis.*

M. suaveolens, fragrant sweetclover, merits consideration as an agricultural crop because it is particularly winter hardy (23). However, the acreage grown is minor. The two accessions, P.I. 251634 and Minn. 114, included in our tests proved highly susceptible to weevil injury. Only three *M. officinalis* accessions and none of *M. alba* sustained as much weevil injury. The adjusted means calculated for these two entries were 58 and 60 percent defoliation, respectively.

Sweetclover Weevil Resistance in the *Macromelilotus*

The Caspian sweetclovers, subgenus *Macromelilotus,* were represented by three species: *M. altissima, M. hirsuta,* and *M. wolgica. M. altissima* was as susceptible as the commercial varieties. For this species the adjusted means ranged from 46 to 51 percent defoliation. Both *M. hirsuta,* represented by a single entry, and *M. wolgica* were about as susceptible as *M. dentata.* The adjusted mean calculated for *M. hirsuta* was 34 percent defoliation; for *M. wolgica* the range was from 35 to 41 percent.

Summary of Field Observations on *Melilotus*

On the basis of these studies, the various *Melilotus* species may be ranked according to their relative resistance to sweetclover weevil injury as follows: *M. infesta,* with an average adjusted mean estimate of defoliation of 15.3 percent for 3 entries; *M. sulcata,* 26.8 percent for 16 entries; *M. taurica,* 29.8 percent for 5 entries; *M. hirsuta,* 34.0 percent for 1 entry; *M. macrocarpa,* 42.0 percent for 1 entry; *M. italica,* 42.6 percent for 5 entries; *M. segetalis,* 42.6 percent for 8 entries; *M. alba,* 43.5 percent for 195 entries; *M. officinalis,* 49.5 percent for 222 entries; *M. elegans,* 56.0 percent for 2 entries; *M. indica,* 58.6 percent for 32 entries; *M. suaveolens,* 59.0 percent for 2 entries; and *M. neapolitana,* 63.0 percent for 1 entry.

Sweetclover Weevil Resistance in the *Medicagos*

The performance of the *Medicagos,* particularly *M. sativa,* was of special interest since alfalfa production is rarely limited by sweetclover weevil. The adjusted means for *M. sativa* ranged from 23 to 27 percent defoliation. Possession of resistance comparable to that of alfalfa perhaps could be used as a standard in the development of weevil-resistant sweetclover varieties. That level of weevil resistance was found in only two sweetclovers: *M. infesta* and *M. sulcata.* Several accessions of *M. taurica* and *M. dentata* had a resistance approaching that of alfalfa.

Several species of *Medicago* apparently were immune to weevil attack. Included in this category were *M. arabica* Medic., *M. auriculata* All., *M. gerardi* W.K., *M. laciniata* Mill., *M. littoralis* Rhode, *M. lupulina* L., *M. minima* L., *M. obscura* Retz., *M. polymorpha* Roxb., *M. scutellata* Mill., *M. truncata* (Desr.)

Burnat, *M. tribuloides* Desr., *M. tuberculata* Willd., and *M. turbinata* Willd.

Two species, *M. falcata* L. and *M. tianschanica* Vassilica, were nearly as susceptible as was *M. sativa,* the most susceptible of the *Medicagos* surveyed. *M. pironae* Vis., *M. pubescens* Hornen., and *M. tornata* Webb. were attacked but those entries were less susceptible than *M. sativa.*

Sweetclover Weevil Resistance in the *Trigonellas*

Species in the genus *Trigonella* were shown by Manglitz and Gorz (14) to elicit diverse responses from the sweetclover weevil. Of the 19 *Trigonella* species included in their trials, 6 were considered nonhosts, 2 were borderline, and 11 were hosts. Only *T. foenum-graecum* L. proved as resistant as *M. infesta.* In this study, 15 accessions of *T. foenum-graecum* were included in field trials. This species was essentially immune from sweetclover weevil attack. Entries of several other *Trigonella* species did not differ statistically from immunity. These entries included: *T. kotschyi* Boiss., *T. noeana* Boiss., *T. monspeliaca* L., *T. polycerata* L., and one of the *T. caerulea* (L.) Seringe, P.I. 244288, accessions.

All *Trigonella* species found to differ significantly from immunity had, with the exception of *T. caelesyriaca* Boiss., previously been demonstrated to be hosts for the sweetclover weevil by Manglitz and Gorz (14). But these workers regarded the injury to *T. spicata* Sibth. and Sm. as so slight that they classed this species as a nonhost. In this report, any accession on which the weevil will feed is considered a host unless it can be demonstrated that the weevil cannot maintain itself on that plant.

Laboratory Studies of Sweetclover Weevil Host Preferences

Methods

During the winter of 1964-65, a series of 27 tests was made to investigate the host preferences of the sweetclover weevil under laboratory conditions. These tests were undertaken to develop laboratory screening procedures that could be correlated with field performance. With few exceptions, the plant materials used in the laboratory trials also had been tested in the field.

Weevils for these experiments were collected from various first-season sweetclover stands near Crookston, Minnesota, in the fall of 1964. The insects were stored in polyethylene trays with airtight lids at 5° C. A small quantity of *M. officinalis,* variety Goldtop, was placed in each tray to maintain the humidity. Minimal feeding occurred during storage.

Sweetclover seedlings were grown in a chamber programmed for 16 hours of light at 27° C. and 8 hours of darkness at 20° C. Seed of each accession was planted in individual 20 $cm.^2$ polystyrene trays filled with a greenhouse soil mixture consisting of one-third sand, one-third peat, and one-third mineral soil by volume. When the seedlings were approximately 1 month old and had from two to four trifoliate leaves, they were transplanted into large fiber glass trays used as the test environment. For this purpose, trays 35 by 27 by 10 cm. were approximately one-half filled with the above soil mixture. Into each tray, 48 seedlings were transplanted in a 6 by 8 design with 3.5 cm. between plants. Goldtop was used as a check variety in all tests. A six-block design was used but limitations in plant material were encountered frequently. Whenever possible, one seedling of each accession in the test was planted per block. Therefore, each accession in that test occurred one to six times, depending on availability of material. *M. alba,* variety Denta, was represented by six seedlings in all but two tests; on two other occasions, 12 seedlings of Denta were used to complete trays. After transplanting, the trays were watered and then held 2 days to permit the surface to dry and the plants to become established.

The tests were conducted in cages 42 by 50 by 25 cm. These cages were constructed of wood with screened sides and a glass top. The tray of seedlings was set flush in the cage floor and was supported by the flanged upper rim of the tray.

Approximately 200-300 weevils were introduced directly from cold storage into each cage. For the duration of the test, the cages were held in a darkened room at 24-27° C. The weevils were permitted to feed about 48 hours, although this time was varied to achieve reasonably uniform injury to the Goldtop checks from test to test. The injury to seedlings was estimated by the same techniques used in the field studies. The range of means for the Goldtop checks was from 12.1 to 75.6 percent defoliation with a mean of 38.2 percent.

Data obtained for each entry were weighted relative to the injury to the six Goldtop check seedlings. Injury to the check was set at 38.2 percent and the other values were adjusted proportionately. The accession means (table 3) were calculated from the total number of weighted evaluations obtained for that entry in the 27 individual tests.

Results

The feeding preferences of the sweetclover weevil in the laboratory (table 3) did not differ appreciably from the data obtained in the field (table 2).

M. infesta was decidedly the most resistant species. None of the 10 seedlings of Bdn. 61-98 was fed upon. Manglitz and Gorz (14) had observed previously that this accession was immune. Injury to the other two *M. infesta* accessions was very slight.

M. sulcata was the second most resistant species. P.I. 206383 and Bdn. 862 sustained the least injury.

One entry of *M. segetalis,* P.I. 208686, was highly unacceptable to the weevils. Hedlin (8) rated this entry highly resistant in his preference tests with excised leaves. It was also the most resistant *M. segetalis* entry screened in the field trials.

Although seedlings of *M. indica* and *M. neapolitana* sustained relatively severe injury from weevil feeding, the injury was relatively less in laboratory tests than in the field. According to this data, the weevil shows no preference for *M. indica* and *M. neapolitana* over *M. alba* or *M. officinalis* but the former species are less tolerant of injury due to a lack of vigor.

Two *M. taurica* accessions sustained slight injury but another, Bdn. 540, was fed upon voraciously in the laboratory tests.

In these tests, all *M. dentata* accessions were subject to less injury than was sustained by any *M. officinalis* entry and by most *M. alba* entries. P.I. 165554 was one of the most susceptible *M. alba* entries in the field; however, it sustained less defoliation than any other *M. alba* accession tested in the laboratory. But Hubam, which is often regarded as slightly resistant, sustained more injury than any other accession of *M. alba.*

M. polonica was represented in the laboratory tests by four seedlings of Bdn. 58-45. These seedlings were fed upon readily. On the basis of this limited observation, it seems unlikely that this species could be a source of any appreciable resistance.

Defoliation of the two alfalfa varieties, Ranger and Vernal, was about half that sustained by Goldtop. Vernal proved a little more resistant than Ranger. All three of the *M. infesta* accessions tested, one accession of *M. segetalis,* two of *M. messanensis,* and three of *M. sulcata* sustained less injury than Vernal alfalfa. Another entry of *M. dentata,* two of *M. sulcata,* and two of *M. taurica* were intermediate in resistance between Vernal and Ranger. These various sweetclover accessions all appear to possess a greater resistance to the sweetclover weevil than is inherent in our commercial sweetclover varieties. If this resistance could be transferred to *M. alba* and *M. officinalis,* the sweetclover weevil would no longer limit production of this crop. Plant breeders may be able to exploit *M. dentata* to impart an appreciable resistance to future sweetclover varieties. The very high levels of resistance found in certain species of *Micromelilotus* are presently inaccessible but this situation may change with further research on interspecific hybridization within this genus.

Table 1. Calculation of adjusted means for data on resistance to injury by the sweetclover weevil by the Patterson Method from entries common to the 4 years of study, Crookston, Minn., 1963-66

species and identification	origin	estimated % defoliation 1963[a]	1964[a]	1965[a]	1966[a]	mean
Melilotus alba Desr.						
Austrian White	Peterson Seed, Mpls.	57.5	34.2	14.6	47.5	38.5
Denta	Wisconsin	62.5	37.9	17.1	50.8	42.1
Melilotus dentata (W.& K.) Pers.						
P.I. 205530	Wisconsin	50.8	27.9	10.8	33.7	30.8
P.I. 205531	Wisconsin	48.8	24.6	21.7	32.1	31.8
Melilotus elegans Salzm.						
P.I. 250873	Iran	73.1	51.3	20.4	60.0	51.2
Melilotus indica (L.) All.						
P.I. 227113	Greece	77.5	45.0	18.3	60.8	50.4
Melilotus italica (L.) Lam.						
P.I. 193951	Italy	57.5	39.6	18.3	44.2	39.9
Melilotus messanensis (L.) All.						
P.I. 231233	Tunisia	56.3	27.1	19.2	43.7	36.6
P.I. 227001	Israel	59.4	40.8	17.9	45.0	40.8
Melilotus officinalis (L.) Lam.						
A-46	Wisconsin	59.4	44.6	21.7	55.0	45.2
S-65	Wisconsin	61.3	43.3	22.5	55.8	45.7
Erector	Saskatchewan	66.3	49.2	18.3	58.3	48.0
Minn. 30	Unknown	70.0	43.8	20.8	58.7	48.3
Goldtop	Wisconsin	61.3	42.1	22.5	53.7	49.5
Melilotus sulcata Desf.						
P.I. 202512	Morocco	32.5	8.3	6.3	21.2	17.1
P.I. 226539	Morocco	38.1	10.0	5.4	27.1	20.2
P.I. 227003	Portugal	36.3	17.5	9.6	36.7	25.0
P.I. 206383	Cyprus	51.9	13.3	6.3	37.5	27.3
P.I. 226278	Kenya	66.3	33.8	17.1	47.9	41.3
Melilotus taurica (M.B.) Ser.						
P.I. 67512	Crimea	34.4	23.8	12.1	31.2	25.4
Total		1,121.2	658.1	320.9	900.9	
Mean		56.1	32.9	16.0	45.0	37.5
Environmental effect[a]		18.6	-4.6	-21.5	7.5	

[a]Environmental effects used to calculate adjusted means for those accessions not represented in all of the tests (Table 2).

Table 2. The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963: June 29-July 1, 1964: July 7, 1965: and July 13-14, 1966

species and identification	origin	estimated % defoliation 1963[a]	1964[a]	1965[a]	1966[a]	adjusted mean[b]
Melilotus alba Desr.						
Bdn. 1926	Germany			12(6)		34
Bdn. 60-93	U.S.S.R.		30(18)			35
Bdn. 459	France		31(18)			36
Bdn. 668	Germany		32(18)			36
Bdn. 442	Sweden		32(18)			37
Bdn. 447	France		32(18)			37
Bdn. 631	Australia		32(18)			37
P.I. 211611	Afghanistan	58(49)	33(20)			38
Bdn. 453	England		33(20)			38
Bdn. 456	Norway		33(20)			38
Bdn. 647	England		33(20)			38
Bdn. 651	Switzerland		34(20)			38
Bdn. 781	England		33(20)			38
Bdn. 782	Poland		30(18)		48(44)	38
Bdn. 932	Czechoslovakia		34(20)			38
Bdn. 1929	France			16(11)		38
Bdn. 1933	Germany			16(11)		38
Bdn. 1935	Norway			16(11)		38
Bdn. x58-100	Poland				46(44)	38
Austrian White	Peterson Seed, Mpls.	58(49)	34(22)	15(9)	48(44)	38
Bdn. 623	Germany		35(22)			39
Bdn. 646	Switzerland		35(22)			39
Bdn. 671	Belgium		34(20)			39
Bdn. 790	Germany		35(22)			39
Bdn. 58-131	Poland		34(20)			39
Bdn. 58-133	Poland		35(22)			39
Bdn. 452	Scotland		35(22)			40
Bdn. 455	Germany		36(22)			40
Bdn. 633	Australia		35(22)			40
Bdn. 650	Switzerland		36(22)			40
Bdn. 660	Sweden		35(22)			40
Bdn. 928	Leningrad		35(22)			40
Bdn. 946	Poland				48(44)	40
Bdn. 958	Germany				48(44)	40
Bdn. 1928	Germany			19(13)		40
Bdn. 1930	U.S.S.R.			19(13)		40
Bdn. 58-137	Leningrad		36(22)			40
Bdn. 58-142	Leningrad		36(22)			40
Bdn. 61- 10	Poland				48(44)	40
Bdn. 61- 11	Poland				48(44)	40
Bdn. x903	Belgium				48(44)	40
Bdn. x904	Germany				48(44)	40
Bdn. x924	Germany				48(44)	40
Hubam	Northrup King, Mpls.	58(49)				40
Bdn. 457	Portugal		36(22)			41
Bdn. 548	New Zealand				49(44)	41
Bdn. 620	Unknown		36(22)			41
Bdn. 622	Germany		37(24)			41
Bdn. 626	France		36(22)			41
Bdn. 657	Switzerland		37(24)			41
Bdn. 663	England		36(22)			41
Bdn. 935	Germany				49(44)	41
Bdn. 948	Poland				49(44)	41
Bdn. 951	Argentina		37(24)			41
Bdn. 1918	Czechoslovakia			19(13)		41

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation				adjusted mean[b]
		1963[a]	1964[a]	1965[a]	1966[a]	
Bdn. 1921	Austria		39(25)	17(11)		41
Bdn. 1931	Sweden			19(13)		41
Bdn. x735	Netherlands				49(44)	41
Bdn. x926	Germany				49(44)	41
Bdn. x58-111	Germany				49(44)	41
Bdn. x58-118	Austria				49(44)	41
Bdn. x58-121	Poland				49(44)	41
Bdn. x60- 82	France				49(44)	41
Bdn. x60- 95	Germany				49(44)	41
Bdn. 446	Germany		37(24)			42
Bdn. 448	Finland		38(24)			42
Bdn. 621	Germany				50(44)	42
Bdn. 655	Switzerland		38(24)			42
Bdn. 667	Belgium		37(24)			42
Bdn. 1937	U.S.S.R.			20(14)		42
Bdn. 61- 14	England				50(44)	42
Bdn. x666	Italy				50(44)	42
Bdn. x738	Germany				50(44)	42
Bdn. x755	Netherlands				50(44)	42
Bdn. x789	Netherlands				50(44)	42
Bdn. x807	England				50(44)	42
Bdn. x916	France				50(44)	42
Bdn. x58-109	Germany				50(44)	42
Bdn. x60- 84	Germany				50(44)	42
Bdn. x60- 85	Bulgaria				50(44)	42
Bdn. x60- 87	Bulgaria				50(44)	42
Arctic	Saskatchewan	61(56)				42
Bdn. Dwarf	Manitoba	60(56)	38(24)			42
Denta	Wisconsin	63(56)	38(24)	17(11)	51(44)	42
P.I. 90186	Manchuria	62(56)				43
P.I. 202040	Argentina	62(56)				43
P.I. 202041	Argentina	62(56)				43
P.I. 202452	Argentina	62(56)				43
P.I. 253454	Yugoslavia	62(56)				43
Bdn. 550	Belgium		36(22)		53(46)	43
Bdn. 634	Denmark		39(25)			43
Bdn. 669	Germany		38(24)			43
Bdn. 792	Portugal		37(24)		52(45)	43
Bdn. 810	Italy		41(27)		49(44)	43
Bdn. 941	Poland				51(44)	43
Bdn. 945	Poland				51(44)	43
Bdn. 950	Germany				50(44)	43
Bdn. 1920	Hungary			22(16)		43
Bdn. 58-138	Leningrad		39(25)			43
Bdn. 60- 91	Belgium				51(44)	43
Bdn. x730	Belgium				51(44)	43
Bdn. x743	England				51(44)	43
Bdn. x796	Germany				50(44)	43
Bdn. x811	France				51(44)	43
Bdn. x905	Germany				50(44)	43
Bdn. x914	Netherlands				51(44)	43
Bdn. x920	Germany				51(44)	43
Bdn.x58-102	Romania				50(44)	43
Bdn.x58-103	Poland				50(44)	43
Bdn.x58-107	Finland				51(44)	43

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation 1963[a]	1964[a]	1965[a]	1966[a]	adjusted mean[b]
Bdn. x58-134	U.S.S.R.				51(44)	43
Bdn. x58-265	Czechoslovakia				50(44)	43
P.I. 179372	Turkey	63(56)				44
P.I. 187005	Iowa	63(56)				44
Bdn. 444	Germany		40(25)			44
Bdn. 464	New Zealand				52(45)	44
Bdn. 628	Germany		40(25)		51(44)	44
Bdn. 653	Switzerland		39(25)			44
Bdn. 661	France		40(25)			44
Bdn. 672	Germany		40(25)			44
Bdn. 673	France		40(25)			44
Bdn. 61- 9	Switzerland				52(45)	44
Bdn. 62- 5	France				52(45)	44
Bdn. 62- 7	U.S.S.R.				52(45)	44
Bdn. x787	France				52(45)	44
Bdn. x806	England				52(45)	44
Bdn. x911	England				52(45)	44
Bdn. x58-104	Hungary				52(45)	44
Bdn. x58-114	Portugal				52(47)	44
Bdn. x58-127	Poland				52(45)	44
diploid annual	Northrup King, Mpls.	62(56)				44
P.I. 202701	Uruguay	63(56)				45
P.I. 205300	Turkey	64(56)				45
P.I. 208684	Algeria	63(56)				45
P.I. 263495	Israel	64(56)				45
Bdn. 648	Switzerland		40(25)			45
Bdn. 656	Switzerland		40(25)			45
Bdn. 944	Scotland				53(46)	45
Bdn. 949	Germany				53(45)	45
Bdn. 1918	Czechoslovakia		40(25)			45
Bdn. 1923	U.S.S.R.			24(18)		45
Bdn. 58-132	U.S.S.R.		40(25)			45
Bdn. 60- 89	Hungary		41(27)			45
Bdn. 60- 92	Hungary				53(45)	45
Bdn. 62- 4	Italy				53(46)	45
Bdn. x654	Germany				53(46)	45
Bdn. x58-108	Germany				53(45)	45
Bdn. x58-123	Switzerland				53(46)	45
P.I. 52916	Spain	64(56)				46
P.I. 204895	Turkey	65(56)				46
P.I. 232928	Hungary	65(56)				46
P.I. 262551	Bulgaria	65(56)				46
Bdn. 649	Unknown				54(47)	46
Bdn. 670	Poland		41(27)			46
Bdn. 933	Germany				54(47)	46
Bdn. 953	Germany				54(47)	46
Bdn. x802	Hungary				54(47)	46
P.I. 90031	Spain	66(56)				47
P.I. 173741	Turkey	66(56)				47
P.I. 212247	Yugoslavia	66(56)				47
Bdn. 451	England		42(28)			47
Bdn. 627	Germany		43(29)			47
Bdn. 791	England		43(29)			47
Bdn. 60- 94	France				55(48)	47
Bdn. x786	Germany				55(47)	47

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation 1963[a]	1964[a]	1965[a]	1966[a]	adjusted mean[b]
Bdn. x58-126	Norway				55(48)	47
Evergreen	Agronomy, U.Minn.	66(56)				47
P.I. 178983	Turkey	67(58)				48
P.I. 198965	Cyprus	66(56)				48
P.I. 205299	Turkey	67(58)				48
P.I. 206701	Turkey	67(58)				48
Bdn. 58-115	Canada				56(49)	48
Bdn. 58-117	France				56(49)	48
Bdn. x58-112	Romania				54(48)	48
P.I. 190878	Canada	68(58)				49
P.I. 193292	Yugoslavia	68(58)				49
Cumino	Saskatchewan	69(59)	46(32)		54(48)	49
Spanish	Agronomy, U.Minn.	68(58)				49
P.I. 178740	Turkey	69(59)				50
P.I. 213323	Afghanistan	69(59)				50
Israel	Northrup King, Mpls.	68(58)				50
P.I. 200355	Israel	70(61)				51
P.I. 204899	Turkey	70(61)				51
Bdn. 58-130	Poland		47(33)			51
Alpha	Saskatchewan	69(59)				51
Bdn. 458	Italy		48(33)			52
Bdn. x733	Portugal				60(53)	52
P.I. 251838	Austria	71(61)				53
P.I. 263496	Israel	71(61)				53
P.I. 165554	India	74(64)				55
P.I. 260753	Cyprus	74(64)				55
Bdn. 662	Portugal		50(35)			55
P.I. 90755	China	75(66)	50(35)			56
Bdn. 441	Sweden		51(37)			56
Bdn. 665	England		51(37)			56
Melilotus altissima Thuill.						
Bdn. 992	Germany		44(30)	23(17)		46
Bdn. 58-262	Hungary		43(29)			48
Bdn. 58-259	Denmark		44(30)			49
Bdn. 58-243	France		47(33)			51
Melilotus dentata (W. & K.) Pers.						
Bdn. 60-112	Hungary		25(12)			29
Bdn. 58-190	U.S.S.R.		25(12)			30
P.I. 205530	Wisconsin	50(44)	28(18)	11(5)	33(28)	31
P.I. 205531	Wisconsin	49(44)	25(12)	22(16)	32(28)	32
P.I. 223000	Iran	56(49)	25(12)	15(9)		34
Bdn. S-410	Saskatoon			13(8)		34
P.I. 205533	Wisconsin	52(44)		15(10)		35
P.I. 213324	Western Siberia	58(49)		13(8)		36
P.I. 116708	Russia	57(49)				38
Bdn. 336	Unknown		34(20)			38
Bdn. 60-195	Hungary		34(20)			38
Bdn. 532	Iowa			18(12)		39
Melilotus elegans Salzm.						
P.I. 250873	Iran	73(63)	51(37)	20(14)	60(53)	51
Bdn. 61-134	Israel		57(43)			61
Melilotus hirsuta Lipsky						
[illegible] 58- 44	Wisconsin			12(6)		34

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation				adjusted mean[b]
		1963[a]	1964[a]	1965[a]	1966[a]	
Melilotus indica (L.) All.						
P.I. 244286	Spain	78(68)		18(12)		49
P.I. 220809	Afghanistan	78(68)		20(14)		50
P.I. 227113	Greece	78(68)	45(31)	18(12)	61(54)	50
P.I. 208173	Union of S. Africa	81(71)		18(12)		51
P.I. 263498	Israel	72(62)	45(31)			51
P.I. 202511	Morocco		49(25)			54
P.I. 250783	Afghanistan	74(64)				56
P.I. 220302	Afghanistan	74(66)				57
P.I. 260754	Israel	76(66)				58
P.I. 260756	Turkey	76(66)				58
P.I. 206326	Argentina	83(74)	61(48)	25(19)		59
P.I. 214116	Spain	78(68)				59
P.I. 226472	Iran	78(68)				59
P.I. 206382	Cyprus	78(68)				60
P.I. 215596	India	79(70)				60
P.I. 219929	Afghanistan	79(70)				60
P.I. 220022	Afghanistan	79(70)				60
P.I. 250784	Afghanistan	79(70)				60
P.I. 256937	France	78(68)				60
P.I. 260755	Turkey	78(68)				60
P.I. 163297	India	83(74)	53(38)			61
P.I. 206385	Cyprus	79(70)				61
P.I. 219600	Pakistan	80(71)				61
P.I. 220532	Afghanistan	79(70)				61
P.I. 238339	Australia	77(68)	59(45)			61
P.I. 227036	Iran	81(71)				62
P.I. 234674	France	81(71)				62
P.I. 170816	Turkey	81(71)				62
P.I. 220387	Afghanistan	82(73)				63
P.I. 260757	Portugal	81(71)				63
P.I. 263497	Israel	81(71)				63
P.I. 164373	India	83(74)				64
Melilotus infesta Guss.						
P.I. 208685	Algeria		5(0)			10
Bdn. 62- 9	Hungary		8(0)			12
Bdn. 61-98	Algeria		8(0)	14(9)		24
Melilotus italica (L.) Lam.						
P.I. 193951	Italy	58(49)	40(25)	18(12)	44(37)	40
Bdn. 856	Sweden			18(12)		40
Bdn. 58-256	Czechoslovakia			21(15)		42
P.I. 202510	Morocco	63(56)				44
P.I. 226538	Morocco			26(20)		47
Melilotus macrocarpa Coss. and Dur.						
Bdn. 61- 97	Algeria		41(27)	18(12)		42
Melilotus messanensis All.						
P.I. 227418	Portugal	61(52)	24(12)			36
P.I. 231233	Tunesia	56(49)	27(14)	19(13)	44(37)	37
Bdn. 524	Portugal			18(12)		39
P.I. 206384	Cyprus		40(25)	14(9)		40
P.I. 227001	Israel	59(52)	41(27)	18(12)	45(38)	41
P.I. 198966	Cyprus	59(52)	38(24)	20(14)		42

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification		origin	estimated % defoliation				adjusted mean[b]
			1963[a]	1964[a]	1965[a]	1966[a]	
Melilotus neapolitana Ten.							
Bdn.	58-245	Portugal		58(44)			63
Melilotus officinalis (L.) Lam.							
Bdn.	1950	Hungary			15(9)		37
Bdn.	698	Poland		35(22)			39
Bdn.	1946	France			19(13)		40
Bdn.	1954	Germany			19(13)		40
P.I.	77464	Russia	63(56)	36(22)			42
P.I.	90557	Manchuria	61(52)				42
Bdn.	689	Netherlands		38(24)			42
Bdn.	1951	Germany			20(14)		42
Bdn.	1947	Poland			21(15)		42
Bdn.	1956	Turkey			21(15)		42
Bdn.	58-178	Poland				50(44)	42
Bdn.	625	France		38(24)			43
Bdn.	1953	Germany			22(16)		43
Goldtop		T.C.Seed Co.,Mpls.	62(53)				43
Bdn.	470	France		39(25)			44
Bdn.	674	France		39(25)			44
Bdn.	722	England		40(25)			44
Bdn.	1945	France			23(17)		44
Bdn.	1948	Poland			23(17)		44
Bdn.	60-110	U.S.S.R.				52(45)	44
Bdn.	476	Yugoslavia		40(25)			45
Bdn.	549	Belgium		40(25)			45
Bdn.	688	Switzerland		41(27)			45
Bdn.	692	Portugal		41(27)			45
Bdn.	704	England		41(27)			45
Bdn.	750	Portugal		40(25)			45
Bdn.	753	Switzerland		41(27)			45
Bdn.	833	Germany		41(27)			45
Bdn.	1949	U.S.S.R.			23(17)		45
A-46		Wisconsin	59(52)	45(31)	22(16)	55(48)	45
Common Yellow		T.C.Seed Co.,Mpls.	64(56)				45
P.I.	178985	Turkey	64(56)				46
P.I.	204896	Turkey	64(56)				46
Bdn.	675	Germany		42(28)			46
Bdn.	690	Finland		42(28)			46
Bdn.	696	Poland		42(28)			46
Bdn.	58-181	Czechoslovakia				54(48)	46
Erector		Manitoba	65(56)				46
Madrid		T.C.Seed Co.,Mpls.	65(56)				46
S-65		Wisconsin	61(52)	43(29)	23(17)	56(49)	46
Bd.	474	Germany		43(29)			47
Bdn.	485	Germany		43(29)			47
Bdn.	694	Germany		43(29)			47
Bdn.	699	Germany		43(29)			47
Bdn.	763	Norway			55(48)		47
Bdn.	838	Denmark				55(48)	47
Bdn.	1016	France				55(48)	47
Bdn.	1946	Denmark		42(28)			47
Bdn.	58-8	England		43(29)			47
Bdn.	58-149	Romania				55(48)	47

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation 1963[a]	1964[a]	1965[a]	1966[a]	adjusted mean[b]
Bdn. 59- 39	Germany				55(48)	47
Bdn. 62- 11	U.S.S.R.				55(48)	47
Bdn. 62- 18	U.S.S.R.				55(48)	47
P.I. 205197	Turkey	66(56)				48
P.I. 205302	Turkey	66(56)				48
P.I. 205538	Nebraska	67(58)				48
Bdn. 469	Portugal				56(49)	48
Bdn. 471	Germany		43(29)			48
Bdn. 473	Finland		44(30)			48
Bdn. 481	Netherlands		43(29)			48
Bdn. 487	Switzerland		43(29)			48
Bdn. 684	Germany		43(29)			48
Bdn. 697	Netherlands		44(30)			48
Bdn. 707	Switzerland				55(48)	48
Bdn. 766	Italy				56(49)	48
Bdn. 771	Germany				56(49)	48
Bdn. 894	Denmark				56(49)	48
Bdn. 896	Germany				56(49)	48
Bdn. 58-158	Poland				55(48)	48
Bdn. 58-159	France				56(49)	48
Bdn. 58-163	France				56(49)	48
Bdn. 61- 22	Poland				56(49)	48
Bdn. 61- 26	Poland				55(48)	48
Bdn. 62- 12	France				56(49)	48
Bdn. 62- 13	Iran				55(48)	48
Minn. 30	Unknown	70(61)	44(30)	21(15)	59(52)	48
Minn. 76	Unknown	70(61)	39(25)			48
Erector	Saskatchewan	66(56)	49(35)	18(12)	58(51)	48
P.I. 90035	Spain	68(58)				49
P.I. 204897	Turkey	68(58)				49
P.I. 204902	Turkey	68(58)				49
P.I. 208073	Turkey	68(58)				49
Bdn. 752	Germany		45(31)			49
Bdn. 813	Italy				57(50)	49
Bdn. 845	France		45(31)			49
Bdn. 874	Germany				57(50)	49
Bdn. 991	Poland				57(50)	49
Bdn. 58-160	Austria				57(50)	49
Bdn. 58-161	Netherlands				57(50)	49
Bdn. 58-169	France				57(50)	49
Bdn. 58-179	Argentina				57(50)	49
Bdn. 58-187	Romania				57(50)	49
Bdn. 58-188	Germany				57(50)	49
Bdn. 58-251	Czechoslovakia				57(50)	49
Bdn. 60-103	Sweden		45(31)			49
Bdn. 61- 19	Switzerland				57(50)	49
Bdn. 61- 20	Estonia				57(50)	49
Bdn. 62- 2	Hungary				57(50)	49
Bdn. 62- 15	Germany				57(50)	49
P.I. 67511	Russia	69(59)				50
P.I. 90037	Spain	68(58)				50
P.I. 108653	Russia	69(59)				50
P.I. 132269	Romania	69(59)				50
P.I. 204898	Turkey	68(58)				50
P.I. 204900	Turkey	69(59)				50

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification		origin	estimated % defoliation				adjusted mean[b]
			1963[a]	1964[a]	1965[a]	1966[a]	
P.I.	205301	Turkey	68(58)				50
P.I.	205536	Canada	69(59)				50
P.I.	222114	Afghanistan	69(59)				50
P.I.	228351	Iran	68(58)				50
P.I.	256938	France	69(59)				50
Bdn.	478	Italy				58(51)	50
Bdn.	480	Switzerland		45(31)			50
Bdn.	676	Italy		46(32)			50
Bdn.	678	Sweden		45(31)			50
Bdn.	768	France		45(31)			50
Bdn.	772	England				58(51)	50
Bdn.	773	Netherlands				58(51)	50
Bdn.	841	Denmark				58(51)	50
Bdn.	846	Germany				58(51)	50
Bdn.	988	Germany				58(51)	50
Bdn.	990	Germany				58(51)	50
Bdn.	994	Italy				58(51)	50
Bdn.	997	Poland				58(51)	50
Bdn.	58-150	Italy				58(51)	50
Bdn.	58-151	Switzerland		45(31)			50
Bdn.	58-153	France				58(51)	50
Bdn.	58-164	France				58(51)	50
Bdn.	58-176	Switzerland				58(51)	50
Bdn.	58-180	Switzerland		47(33)		56(49)	50
Bdn.	58-183	Argentina				58(51)	50
Bdn.	58- 37	Germany				58(51)	50
Bdn.	61- 25	France				58(51)	50
Goldtop		Wisconsin	61(52)	42(28)	23(17)	54(48)	50
P.I.	172430	Turkey	70(61)				51
P.I.	172432	Turkey	70(61)				51
P.I.	172990	Turkey	70(61)				51
P.I.	178984	Turkey	69(59)				51
P.I.	204901	Turkey	70(61)				51
P.I.	213327	Canada	69(59)				51
P.I.	213329	Virginia	69(59)				51
P.I.	251425	Yugoslavia	69(59)				51
Bdn.	680	Poland		47(33)			51
Bdn.	681	Switzerland		47(33)			51
Bdn.	703	Italy		46(32)			51
Bdn.	757	Belgium		46(32)			51
Bdn.	760	Germany				59(52)	51
Bdn.	831	Germany		47(33)			51
Bdn.	839	Poland				59(52)	51
Bdn.	843	Germany				59(52)	51
Bdn.	844	Netherlands				59(52)	51
Bdn.	870	Belgium				59(52)	51
Bdn.	963	Germany				59(52)	51
Bdn.	998	Austria				59(52)	51
Bdn.	1000	Germany				59(52)	51
Bdn.	58-152	Czechoslovakia				59(52)	51
Bdn.	58-189	Hungary				59(52)	51
Bdn.	59- 13	France				59(52)	51
Bdn.	59- 42	Belgium				59(52)	51
Bdn.	62- 14	Turkey				59(52)	51
Bdn.	62- 16	Italy				59(52)	51

Table 2 (continued). The relative resistance of various accessions of the plant genera *Melilotus*, *Medicago*, and *Trigonella* to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification		origin	estimated % defoliation 1963[a]	1964[a]	1965[a]	1966[a]	adjusted mean[b]
P.I.	172434	Turkey	71(61)				52
P.I.	173739	Turkey	71(61)				52
P.I.	184117	Yugoslavia	71(61)				52
P.I.	204467	Turkey	71(61)				52
P.I.	205539	Iowa	71(61)				52
P.I.	228288	Iran	71(61)				52
P.I.	229957	Iran	71(61)				52
Bdn.	472	France		48(33)			52
Bdn.	475	Germany		48(33)			52
Bdn.	677	Germany		48(33)			52
Bdn.	693	Switzerland		47(33)			52
Bdn.	695	Germany		48(33)			52
Bdn.	769	Germany				60(53)	52
Bdn.	836	Norway		47(33)			52
Bdn.	872	Germany				60(53)	52
Bdn.	873	Germany				60(53)	52
Bdn.	58-155	Germany				60(53)	52
Bdn.	58-185	Hungary				60(53)	52
Bdn.	59- 38	U.S.S.R.				60(53)	52
Bdn.	61- 18	England				60(53)	52
Bdn.	62- 17	U.S.S.R.				60(53)	52
P.I.	31647	India	71(62)				53
P.I.	88990	Manchuria	71(61)				53
P.I.	89911	Spain	72(62)				53
P.I.	108651	Ukraine	71(61)				53
P.I.	172433	Turkey	72(62)				53
P.I.	174276	Turkey	71(61)				53
P.I.	199260	Greece	71(61)				53
P.I.	205534	Saskatchewan	71(61)				53
P.I.	205537	India	71(61)				53
P.I.	213326	West Virginia	72(62)				53
P.I.	213328	Canada	71(61)				53
P.I.	230875	Yugoslavia	71(61)				53
P.I.	235096	Germany	71(61)				53
Bdn.	477	England		48(33)			53
Bdn.	754	Netherlands		49(35)			53
Bdn.	765	Germany				61(54)	53
Bdn.	996	Netherlands				61(55)	53
Bdn.	1002	France				60(54)	53
Bdn.	58-165	Germany				61(54)	53
Bdn.	58-182	Germany				61(54)	53
Bdn.	58-265	Czechoslovakia				61(54)	53
P.I.	107085	Russia	73(63)				54
P.I.	172991	Turkey	73(63)				54
P.I.	212107	Afghanistan	73(63)				54
P.I.	262552	Bulgaria	73(63)				54
Bdn.	706	Switzerland		49(35)			54
Bdn.	835	Hungary		50(35)			54
Bdn.	58-148	Poland				62(57)	54
P.I.	230351	Iran	74(64)				55
Bdn.	61- 28	Switzerland				63(56)	55
Bdn.	454	Belgium		50(35)			55
P.I.	210368	Iran	73(63)				55
P.I.	89596	China	71(61)	55(40)			56
Bdn.	686	Belgium		51(37)			56
Bdn.	685	Germany		56(42)			60
Bdn.	488	Australia		57(43)			61

Table 2 (continued). The relative resistance of various accessions of the plant genera *Melilotus*, *Medicago*, and *Trigonella* to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation				adjusted mean[b]
		1963[a]	1964[a]	1965[a]	1966[a]	
Melilotus segetalis (Brot.) Ser.						
P.I. 208686	Algeria	50(44)		14(9)		34
Bdn. 535	Iowa			19(13)		40
P.I. 227004	Portugal		35(22)	21(15)		41
Bdn. 1017	Czechoslovakia		38(24)			42
P.I. 227005	Portugal	61(52)		23(17)		43
Bdn. 863	Malta		39(25)			44
Bdn. 58-129	Poland		43(29)		57(50)	48
P.I. 227006	Portugal	68(58)				49
Melilotus speciosa Dur.						
Bdn. 536	Iowa			26(20)		47
Melilotus suaveolens Ldb.						
P.I. 251634	Ethiopia	76(66)	55(40)			58
Minn. 114	Unknown	78(68)	56(42)			60
Melilotus sulcata Desf.						
Bdn. 61- 31	Morocco		10(0)			15
Minn. 85	Unknown	34(32)	14(1)			17
P.I. 202512	Morocco	33(32)	8(0)	6(0)	21(21)	17
Bdn. 1018	Israel		14(0)			19
P.I. 226539	Morocco	38(32)	10(0)	5(0)	27(21)	20
P.I. 227114	Greece		18(5)			23
P.I. 227003	Portugal	36(32)	18(5)	10(4)	37(31)	25
P.I. 229571	Greece	44(38)				26
P.I. 206383	Cyprus	52(44)	13(1)	6(0)	38(31)	27
Bdn. 862	Sweden		20(8)	14(9)		30
Bdn. 58-194	Czechoslovakia		20(8)	14(9)		30
Bdn. 1019	Germany			12(6)		33
P.I. 263499	Israel	53(49)				35
Bdn. 58-263	Czechoslovakia		30(18)	13(8)		35
P.I. 260758	Turkey	64(56)	22(10)			36
P.I. 226278	Kenya	66(56)	34(20)	17(11)	48(44)	41
Melilotus taurica (M.B.) Ser.						
P.I. 67512	Crimea	34(32)	24(12)	12(6)	31(28)	25
P.I. 67510	Crimea	38(32)		13(8)		27
P.I. 67854	Russia	34(32)	28(18)	13(8)		27
Bdn. 540	Iowa			14(9)		35
Bdn. 58-253	Czechoslovakia		29(18)	15(9)		35
Melilotus wolgica Poir.						
Bdn. 58-244	Denmark		30(18)			35
Bdn. 58-246	Denmark			16(11)		37
Bdn. 59- 34	Italy		33(20)			38
Bdn. 60-111	Hungary		34(20)			38
Bdn. 58-254	Czechoslovakia			18(12)		39
Bdn. 59- 50	Hungary		35(22)			40
Bdn. 1022	Denmark		36(22)			41
Medicago arabica Medic.						
P.I. 199253	Greece			0(0)		22
Medicago auriculata All.						
P.I. 244282	Spain			0(0)		22

Table 2 (continued). The relative resistance of various accessions of the plant genera *Melilotus*, *Medicago*, and *Trigonella* to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation				adjusted mean[b]
		1963[a]	1964[a]	1965[a]	1966[a]	
Medicago falcata L.						
P.I. 204885	Turkey		10(0)			15
P.I. 258754	U.S.S.R.		12(0)			17
P.I. 231731	Wisconsin			4(0)		25
P.I. 204885	Turkey			5(0)		26
Medicago gerardi W.K.						
P.I. 287865	Spain			0(0)		22
Medicago hispida Gaertn.						
P.I. 186368	Uruguay			2(0)		24
Medicago laciniata Mill.						
P.I. 244284	Spain			0(0)		22
Medicago littoralis Rhode						
P.I. 255381	Yugoslavia			0(0)		22
Medicago lupulina L.						
P.I. 186370	Uruguay			0(0)		22
P.I. 290723	W. Pakistan			0(0)		22
Medicago minima L.						
P.I. 227032	Iran			0(0)		22
Medicago obscura Retz.						
P.I. 244673	India			0(0)		22
Medicago pironae Vis.						
P.I. 253450	Yugoslavia		5(0)			10
Medicago polymorpha Roxb.						
P.I. 244314	Spain			0(0)		22
P.I. 267931	Iran			0(0)		22
Medicago pubescens Hornen.						
P.I. 245002	Unknown			1(0)		22
Medicago sativa L.						
P.I. 212798	Iran		18(5)			23
P.I. 241882	India		18(5)			23
Bdn. 58-146	Leningrad		14(1)	8(2)		24
P.I. 239955	Algeria			4(0)		25
P.I. 286365	Israel			4(0)		25
P.I. 286379	France			5(0)		26
P.I. 286380	France			5(0)		26
P.I. 208115	Afghanistan			5(0)		27
P.I. 212858	Afghanistan			5(0)		27
P.I. 244674	India			5(0)		27
Medicago scutellata Mill.						
P.I. 161415	Argentina			0(0)		22
Medicago tornata Webb.						
P.I. 197346	Australia			1(0)		22
Medicago truncata (Desr.) Burnat						
P.I. 244285	Spain			0(0)		22

Table 2 (continued). The relative resistance of various accessions of the plant genera Melilotus, Medicago, and Trigonella to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation				adjusted mean[b]
		1963[a]	1964[a]	1965[a]	1966[a]	
Medicago tianschanica Vassilica						
P.I. 270315	Sweden			6(0)		27
Medicago tribuloides Desr.						
P.I. 197360	Australia			0(0)		22
P.I. 239878	Morocco			0(0)		22
Medicago tuberculata Willd.						
P.I. 197367	Australia			0(0)		22
P.I. 287889	Spain			0(0)		22
Medicago turbinata Willd.						
P.I. 287890	Spain			0(0)		22
Trigonella anguina Boiss.						
P.I. 227394	Iran			17(11)		38
Trigonella arabica Delile						
P.I. 194476	Israel		57(43)			62
Trigonella balansae Boiss. and Reut.						
P.I. 164566	India			10(4)		31
Trigonella caelesyriaca Boiss.						
P.I. 284675	Israel			9(4)		30
Trigonella caerulea (L.) Seringe						
P.I. 244288	Spain			6(0)		28
P.I. 206901	Turkey			8(2)		29
Trigonella corniculata L.						
P.I. 244289	Spain			11(5)		32
P.I. 219629	Pakistan			11(5)		33
P.I. 216049	India			16(11)		37
Trigonella foenum-graecum L.						
P.I. 164141	India		0(0)			5
P.I. 164180	India			0(0)		22
P.I. 167246	Turkey			1(0)		22
P.I. 173820	Turkey			0(0)		22
P.I. 180352	India			0(0)		22
P.I. 181814	Syria			0(0)		22
P.I. 194017	Ethiopia			0(0)		22
P.I. 195853	Egypt			0(0)		22
P.I. 199264	Greece			0(0)		22
P.I. 203151	Jordan			0(0)		22
P.I. 211635	Afghanistan			0(0)		22
P.I. 218116	Pakistan			0(0)		22
P.I. 222841	Iran			1(0)		22
P.I. 244060	Africa			0(0)		22
P.I. 249604	Angola			0(0)		22
Trigonella kotschyi Boiss.						
P.I. 206775	Turkey		12(0)	6(0)		22
Trigonella monspeliaca L.						
P.I. 244327	Spain			0(0)		22
P.I. 227051	Iran			2(0)		23

Table 2 (continued). The relative resistance of various accessions of the plant genera *Melilotus*, *Medicago*, and *Trigonella* to feeding injury by the sweetclover weevil, Crookston, Minn., June 21-22, 1963; June 29-July 1, 1964; July 7, 1965; and July 13-14, 1966

species and identification	origin	estimated % defoliation				adjusted mean[b]
		1963[a]	1964[a]	1965[a]	1966[a]	
Trigonella noeana Boiss.						
P.I. 203475	Turkey			0(0)		22
P.I. 229548	Iran			3(0)		24
P.I. 251412	Iran			2(0)		24
P.I. 218239	Afghanistan			4(0)		25
Trigonella polycerata L.						
P.I. 227395	Iran			0(0)		22
Trigonella rigida Boiss. and Bal.						
P.I. 227048	Iran			14(9)		35
Trigonella spicata Sibth. and Sm.						
P.I. 206284	Turkey		1(0)	12(6)		20
Trigonella uncata Boiss. and Noe						
P.I. 226533	Iran			25(19)		46

[a] Duncan's New Multiple Range Test applied to each year's data at 5% level of significance. Values in parenthesis are the lowest estimates of defoliation which are not significantly different from the accession means. Standard error of means for 1963, 1964, 1965, and 1966 is 2.59, 3.87, 1.69, and 2.04, respectively.

[b] Patterson method of calculating comparable means for various varieties in different environments.

Table 3. Laboratory evaluations of host preferences of sweetclover weevil for various accessions of the plant genera Melilotus and Medicago, St. Paul, Minn., winter 1964-65

species and identification	origin	no. of plants evaluated	adjusted mean % defoliation[a]
Melilotus alba Desr.			
P.I. 165554	India	11	26
P.I. 202452	Argentina	11	32
Cumino	Saskatchewan	12	33
Alpha	Saskatchewan	11	35
Austrian White	Peterson Seed Co., Mpls.	22	38
Denta	Wisconsin	162	43
Evergreen	Agronomy, U. Minn.	9	44
Brandon Dwarf	Manitoba	18	48
Hubam	Northrup King, Mpls.	12	77
Melilotus altissima Thuill.			
Bdn. 992	Germany	10	48
Melilotus dentata (W. & K.) Pers.			
P.I. 205533	Wisconsin	12	20
P.I. 305531	Wisconsin	33	28
P.I. 205530	Wisconsin	34	30
Bdn. S-410	Saskatoon	12	32
P.I. 205532	Wisconsin	10	32
Melilotus elegans Salzm.			
Bdn. 61-134	Israel	14	45
P.I. 250873	Iran	7	53
Melilotus hirsuta Lipsky.			
Bdn. 58- 44	Wisconsin	18	26
Melilotus indica (L.) All.			
P.I. 208173	Union of South Africa	18	36
P.I. 227114	Greece	29	36
P.I. 220809	Afghanistan	20	38
P.I. 220387	Afghanistan	10	44
P.I. 206326	Argentina	10	47
P.I. 244286	Spain	16	47
P.I. 219929	Afghanistan	12	50
P.I. 238339	Australia	25	51
P.I. 260757	Portugal	12	64
P.I. 263498	Israel	14	67
M. infesta Guss.			
Bdn. 61- 98	Algeria	10	0
P.I. 208685	Algeria	1	2
Bdn. 62- 9	Hungary	5	4
Melilotus italica (L.) Lam.			
P.I. 193951	Italy	10	27
Bdn. 856	Sweden	19	34
P.I. 226538	Morocco	12	42
Melilotus macrocarpa Coss. and Dur.			
Bdn. 61- 97	Algeria	7	46
Melilotus messanensis (L.) All.			
P.I. 198966	Cyprus	11	13
P.I. 231233	Tunisia	7	16
P.I. 206384	Cyprus	15	27
Bdn. 524	Portugal	26	59
Melilotus neapolitana Ten.			
Bdn. 58-245	Portugal	6	38

Table 3 (continued). Laboratory evaluations of host preferences of sweetclover weevil for various accessions of the plant genera Melilotus and Medicago, St. Paul, Minn., winter 1964-65

species and identification	origin	no. of plants evaluated	adjusted mean % defoliation[a]
Melilotus officinalis (L.) Lam.			
A-46	Wisconsin	12	34
Goldtop	Wisconsin	162	38
Erector	Manitoba	13	39
Common Yellow	T.C. Seed Co., Mpls.	12	46
P.I. 90035		18	50
Madrid		12	69
Melilotus polonica (L.) Desr.			
Bdn. 58-45	Wisconsin	5	39
Melilotus segetalis (Brot.) Ser.			
P.I. 208686	Algeria	12	8
Bdn. 863	Malta	12	32
P.I. 226681	Portugal	3	35
P.I. 227005	Portugal	12	36
Bdn. 535	Iowa	12	58
Melilotus speciosa Dur.			
Bdn. 536	Iowa	16	62
Melilotus suaveolens Ldb.			
Minn. 114	Unknown	18	42
Melilotus sulcata Desf.			
P.I. 202512	Morocco	31	9
Bdn. 862	Sweden	13	13
P.I. 226539	Morocco	10	15
Bdn. 1019	Germany	12	19
P.I. 227003	Portugal	17	21
Minn. 85	Unknown	24	26
Bdn. 58-194	Czechoslovakia	10	26
P.I. 206383	Cyprus	10	30
Melilotus taurica (M.B.) Ser.			
P.I. 67512	Crimea	21	20
Bdn. 58-253	Czechoslovakia	8	21
Bdn. 540	Iowa	31	43
Melilotus wolgica Poir.			
Bdn. 58-246	Denmark	30	47
Bdn. 58-254	Czechoslovakia	25	66
Medicago sativa L.			
Vernal	Agronomy, U. Minn.	14	19
Ranger	Agronomy, U. Minn.	21	25

[a]Data accumulated in 26 tests. Injury evaluations adjusted to base Goldtop checks equal 38.2% defoliation. Accession means calculated on data weighted according to number of entries in individual tests.

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