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BIONOMICS AND CONTROL OF THE CARROT BEETLE (Bothynus gibbosus De Geer) ON CULTIVATED SUNFLOWER

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Occurrence of the carrot or sunflower beetle was reported informally as a destructive pest of cultivated sunflower in Texas at the Third International Sunflower Conference in August 1968, by Brigham (4). A later report at the Fourth International Sunflower Conference in 1970 by Bottrell and Brigham (1) indicated the pest was still present in large numbers in the area, and precluded commercial production of sunflower. Status of research on the pest in Texas was outlined in reports by Botrell et al. (2, 3).

Bothynus gibbosus (De Geer) is a common scarab beetle that is restricted to the New World. It has been officially recorded in 38 states of the continental U.S.A., and in southern Canada. It also probably occurs in Mexico. It was first reported as a pest of sunflower by Comstock in 1881 (5), who noted that the adults fed on roots of wild and cultivated plants. Hayes (6) described the biology of the insect in Kansas, and reported no known measures were effective in controlling it. More recent publications by King (7, 8) indicated rainfall was a key factor in spring emergence of overwintering adults in South Carolina.

Studies on the biology of the insect were initiated at Lubbock in 1969. Field plantings were on Amarillo loam soil, and plots were irrigated.

FEEDING HABITS

Damage to sunflower plants is caused by feeding of adult beetles on the roots. Beetles attack plants from the early seedling stage through the heading stage. Ten to 20 adults have been observed feeding on the roots of a single plant. When a plant wilts and dies, the insects leave the root zone of that plant, making open, circular emergence holes 2 to 6 cm from the plant stem. Mean depth of the feeding zone was found to be 3.55 cm, with a range of 0.6 to 12.9 cm. One adult can destroy all the lateral roots of a small plant, resulting in death of that plant. After adults burrow into the root zone, observations in cages indicate that a mean of 3.64 days (range of 1 to 7 days) elapse from time of entry until emergence from the soil.

SEASONAL HISTORY

Light trap records obtained in 1969 and 1970 showed 2 major seasonal peaks of activity. The first peak apparently represents the emergence and flight of overwintering adults, and the second peak represents the emergence and flight of the first summer generation adults. Larvae of the carrot

beetle wer not found in soils where adults were feeding heavily on sunflower plants, nor were they found in these soils during the winter months. Overwintering adults were found in the top 30 cm of soil following a sunflower planting. Larvae are reported to feed on decaying organic matter in soils typical of pasture land. Observations of a sunflower field planted adjacent to a native grass pasture near Lubbock are in agreement with this report, as the infestation first began nearest the pasture, and spread into the field from that point. Other undisturbed areas such as fence rows, ditch banks, etc... may also afford a place for larvae to live, as few native grass pastures are still in existence in the Lubbock area.

INSECTICIDE CONTROL

A series of field and greenhouse tests in 1969 showed that the adult carrot beetle is not controlled by the application of available insecticides (1). Seed-furrow applications of seven granular insecticides and surface sprays of six insecticides were not effective when used on field-grown sunflowers planted at two dates. Percentage of the plants damaged by beetles ranged from 39 to 75 %. A granular insecticide was applied broadcast to the soil surface at three rates, but 20 to 25 % of the sunflower plants were damaged by the beetle. Seven granular insecticides mixed with soil at different application rates (same materials as used in field) were not effective in controlling adult beetles in greenhouse tests. Eighty to 100 % of the insects remained alive after 16 days following introduction into cages covering seedling plants growing in pots in a greenhouse.

GENOTYPE TOLERANCE

Trials were planted in 1970, 1971, and 1972 to screen for possible tolerance to carrot beetle. The 1970 trial included Peredovick, VNIIMK 8931, NK HO 1, GOR 101, Krasnodarets, P-21 VR1 x Menn. RR-18-1, Arrowhead, and Greystripe. There were no significant differences among varieties, as all entries were severely damaged by the beetle. A wider range of germplasm was tested in 1971, when two replications of 60 entries were planted at two dates. Too few carrot beetles were present in the first planting (planted April 23) to provide and adequate population to evaluate tolerance of the genotypes, as only 1 to 6 % of the plants were damaged. This coincided with a period of low rainfall, which apparently lowered number of emerging adults. The second planting (planted June 29) grew during a period of frequent rainshowers, and an adequate population of beetles was present. Percentage of plants lost ranged from 3.1 % to 45 %. The most tolerant genotypes observed with percentage of plants lost were : INRA 6501 Hybrid, 3.1 % ; Romania 53, 5 % ; HA 68 x HA 61, 6.3 % ; (P-21 VR1 x P-21 VR2) Menn. RR-18-1, 7 % ; Greystripe, 7.6 % ; Kitale (white seed), 8 % ; Peredovick 436, 9 % and Romania 52, 10 %. Two similar plantings were established in 1972, and results will be presented at the Conference.

CONCLUSION

Presently, Texas and adjacent areas of Oklahoma are the ontly known places in the world reporting economic damage to sunflower by the carrot beetle. However, since the insect occurs in many other areas of the U.S.A. adapted to sunflower production, there is reason to believe that it is a potentially serious pest of sunflower in these areas. Also, the insect could be inadvertently transported to other countries of the world, and be an unprecedentes threat to world sunflower production.

BIBLIOGRAPHY

(1) BOTTRELL D.G. and R.D. BRIGHAM - 1970 - The carrot beetle, Bothynus gibbosus (De Geer), problem in cultivated sunflower in the Texas High Plains. Proceedings, Fourth International Sunflower Conference, Memphis, Tenn., June 23-25, 1970 - p. 187-198.

(2) BOTTRELL D.G., R.D. BRIGHAM, B.C. CLYMER and J.R. CATE Jr. - 1970 - Evaluation of insecticides for controlling the carrot beetle in sunflower. Texas Agricultural Experiment Station Progress Report 2831 - 17 p.

(3) BOTTREL D.G., R.D. BRIGHAM and L.B. JORDAN - 1972 - Carrot beetle --- pest status and bionomics on cultivated sunflower. Journal of Economic Entomology (in press).

(4) BRIGHAM Raymond D. - 1968 - Occurrence of the carrot beetle on sunflower, Texas High Plains. Informal report with color slides - Third International Sunflower Conference, Crookston, Minn., August 13-15, 1968.

(5) COMSTOCK J.H. - 1881 - Report of the Entomologist. Part I - Miscellaneous insects. Report of Commission of Agriculture for 1880 - pp. 235-275.

(6) HAYES W.P. - 1917 - Studies on the life-history of Ligyrus gibbosus De G. (Coleoptera). J. Econ. Entomol. 10 - 253-260.

(7) KING E.W. - 1963 - Effect of temperature and rainfall on the spring emergence pattern of the carrot beetle, Ligyrus gibbosus. Ann. Entomol. Soc. Amer. 56 - 826-829.

(8) KING E.W. - 1969 - Determination of the optimum rainfall conditions for spring emergence of the carrot beetle, Bothynus gibbosus (Coleoptera - Scarabaeidae) - Ann. Entomol. Soc. Amer. 62 - 1336 - 1339.