

A Preliminary Response of Exotic Vs. Local Corn Hybrids to Natural Infestation of Two Stem Borers, (LEPIDOPTERA: NOCTUIDAE)

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ABSTRACT. A field test was conducted in the experimental and research station farm of the College of Agriculture, King Saud University at Dirab to evaluate the preliminary response of 3 exotic hybrids versus one local corn variety when planted under natural field population of the Durra stem borer *Sesamia cretica* Led. and the European corn borer *Ostrinia nubilalis* (Hub). Differences due to corn hybrids were highly significant (1%) for the number of cavities/stalk. Difference due to number of larvae per plant, number of cavities/shank and all variety by season interactions were not significant. According to the leaf-feeding ratings, the 4 corn hybrids were either highly resistant, resistant or intermediate to leaf-feeding damage. A highly positive correlation coefficient ($r = 0.8$) exists between the number of larvae recovered from dissection during the whorl stage and the number of larval tunneling (cavities/stalk). Exotic hybrids (Cl 31 A and Oh 43) produced impressive results over the local hybrid.

Introduction

In order to evaluate plant material for insect resistance, an adequate number of insects of a uniform level should be available. Native or natural field populations are sometimes adequate during most seasons to evaluate plant material for resistance to some insect species if climatic conditions prevail for an appreciable period of time^[1]. Although a lot of studies investigating host plant resistance to insect damage has been done with stem borers, *Chilo* spp.^[2-4], further impressive results have been achieved in other stem borers like the European corn borer *Ostrinia nubilalis* (Hubner)^[5-10]. Successive planting of the host plant was a valuable undertaking in circumstances when the native field populations were not adequate and such techniques were used by Starks^[11] to increase the populations of the sorghum

shootfly *Atherigona varia* var. *soccata*, or through collection from emergence cages for adequate egg production for artificial infestation^[7,9]. Therefore, using natural field infestation to evaluate resistance in plant material has been and still practiced for a long time till the need for large numbers of insects for resistance stimulated the development of artificial diets^[12]. Although diverse studies for resistance on different groups of cereal insect pest species were conducted under field conditions, many workers have carried out studies for resistance with native host plants under controlled environments, e.g. the cereal leaf beetle *Oulema melanopus*^[13], the English grain aphid *Macrosiphum avenae*^[14,15], the green bug *Schizaphis graminum*^[16,17], the hesian fly *Mayetiola destructor*^[18] and the wheat midge *Sitodiplosis mosellana*^[19]. All these insects have one criterion in common, a short life cycle, a condition which makes large populations to be reared on seedling plants in a very short period of time.

In Saudi Arabia, cereal production acreage is bound to increase tremendously due to current horizontal and vertical expansion in agricultural production on the marginal land in the outskirts of oases or in the newly created agroecosystems. Stem borers, especially *Sesamia cretica*, has been observed in sorghum and corn fields inflicting noticeable damage. To be considered as a basis for any future management programs for stem borers, this study was conducted to investigate the preliminary response of the resistance of exotic hybrids over a local corn variety to infestation by natural field populations of both the durra stem borer and the European corn borer.

Material and Methods

The test was conducted at the College of Agriculture, Experimental and Research Station of King Saud University at Dirab, 25 km south east of the City of Riyadh. A two-donum (donum = 1000 square meters) experimental plot was selected, and all the preplanting agricultural practices were performed.

Three hybrids of corn, namely, CI 31, Oh 43 and WF 9, provided by the Corn Insect Research Unit, Ankeny, Iowa, U.S.A., and a local variety (from Jizan area) was supplied by the Crop Production Dept., College of Agriculture, King Saud University, were planted in a randomized complete block design, replicated four times.

The layout or the rectangular configuration of the test site was divided into 16 plots (4 hybrids each has 4 plots) and each plot has an area of ca. 75 (5 × 15) square meters, i.e. the distance between any two adjacent plots was 2 meters from all directions, which is used as alleyways. Within each plot, 6 biwall hoses (along which rows of corn would be planted) were laid out at a distance of 1 meter apart, where the first and the 6th rows in each plot would be considered as guard rows and not included in data collection. Areas used for evaluation were situated in the middle of each of the remaining 4 rows in each plot containing 30 consecutive corn plants. The 4 corn hybrids were planted along the hoses of the biwall system of irrigation 40 cm (depending on holes for water exit along the hose) and 2 seeds/hill. After two weeks the plant population was thinned to one plant/hill where poorly growing plants were removed. In the 1st year, corn was planted on Feb. 27, 1982, whereas in the 2nd year on Feb. 23, 1983. The corn plants were then left to be infested by the native natural field populations of both the Durra stalk borer *S. cretica* and the European corn borer, *O. nubilalis*.

Plant damage was found to be a better index of inbred performance than insect counts because many factors including insect diseases, predation and parasitism can result in the absence of viable insect forms at the same time of examination even though extensive plant damage is present. In their relative resistance scale^[11], inbred lines which rate 1 to 3 are considered resistant, lines which rate 4 to 6 are considered intermediate in resistance, and in lines which rate 7 to 9 are considered highly susceptible. Classification into resistant, intermediate or susceptible classes is dependent upon the size and shape of leaf injuries and rating within each class is determined by the number of holes or amount of feeding.

In the present study, the rating scale suggested by Guthrie *et al.*^[7] was adopted for rapid evaluation of the leaf feeding resistance, after being modified into 4 groups, *viz.* classes 1 to 2 (highly resistant) modified to make group A, classes 3 to 4 (resistant) group B, classes 5 to 6 (intermediate resistance) group C, and classes 7 to 9 (susceptible) group D. Data on leaf-feeding was carried out on April 23, 1982 ca. 8 weeks post-transplanting.

When the crop growth reached the whorl stage, 10 plants were dissected from each row, *i.e.* (40 plants/plot), on May 5-8, 1982 (9 weeks post-transplanting), and on May 7-11 (10 weeks post-transplanting) in 1983. The number of larvae (all instars) recovered was recorded. Number of cavities (cm of damage in the stalks and shanks) was made on June 15-16, 1982 (15 weeks post-transplanting), and on June 21-22, 1983 (16 weeks post-transplanting). The remaining 20 plants in each row (80 plants/plot) were split in half from the tassel to the ground, and each 2.5 cm of larval tunneling was recorded as one cavity. An analysis of variance (ANOVA) of the data was performed for means separations.

Results and Discussion

Differences due to corn hybrids were highly significant at 1% level of probability for the number of cavities/stalk (Table 1), whereas differences due to season and the interaction of hybrid \times season was insignificant. The number of larvae (all instars) recorded during dissection (Fig. 1), number of cavities/shank and all their hybrid \times season interactions were also insignificant. The average number of cavities/shank (all hybrids) during 1982 was 0.075, and 0.2 during 1983. According to the leaf-feeding ratings, all the corn hybrids were either highly resistant (group A), resistant (group B) or intermediate (group C) to leaf-feeding damage. It was observed that during the 3rd week after planting there occurred some incidence of deadhearts in the WF 9 and Oh 43 plots but did not reach severe levels. Collar and sheath feeding was very few, and most leaves and sheaths remain intact till splitting time towards the end of the season. Husk feeding damage was observed but did not reach a noticeable level. Although corn was not a major crop planted in the farm, but it was observed that there was some slight increase in the number of larvae collected during dissection in the 2nd season 1983 ca. 90/40 plants as compared with the 1st season 1982 ca. 60/40 plants (Fig. 1). A high positive correlation coefficient ($r = 0.8$) exists between the number of larvae recovered from dissection during the whorl stage of plant growth and the number of larval tunneling (cavities per stalk). It was observed that a

TABLE 1. Effect of native field infestation on stalk damage on 4 corn hybrids, Dirab, K.S.A., 1983.

Corn hybrid	No. cavities ^a /40 plants	
	1982	1983
CI31 A	42	45
Oh 43	80	98
Local	100	130
WF9	200	227
L _{SD}	29.78	

^aone cavity = 2.54 cm of damage.

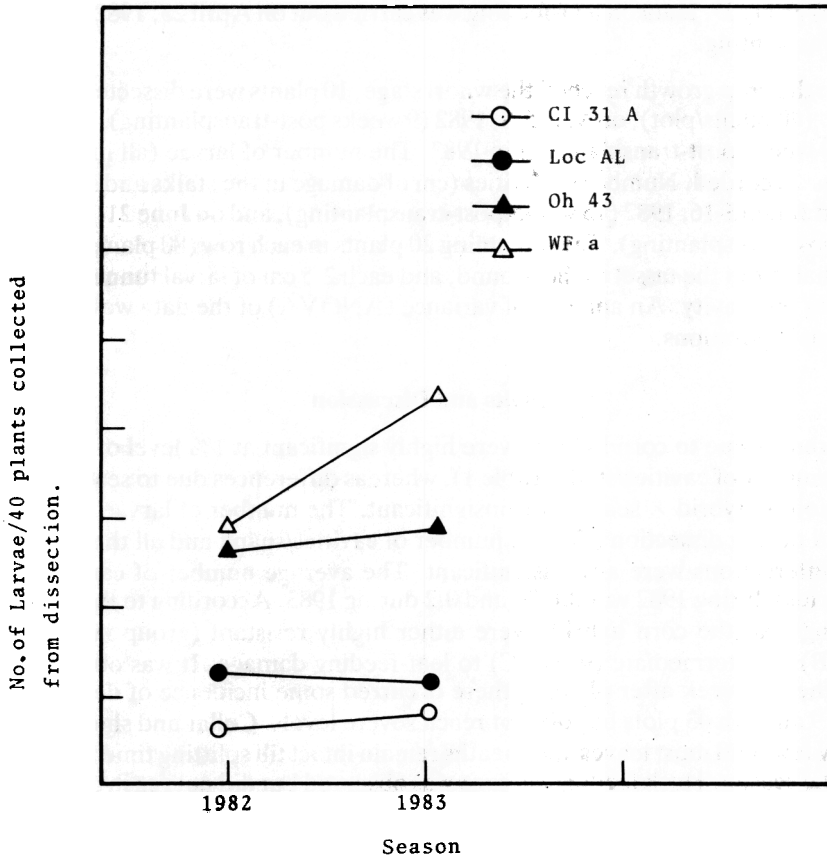


FIG. 1. Number of larvae (all instars) collected from the dissection of 40 plants/plot at the whorl stage (summed over seasons), Dirab, KSU, Saudi Arabia, 1983.

high degree of tolerance to infestation was displayed by the excellent crop stand and ear-holding qualities of all 4 hybrids, where no ear-droppage was reported, hence practically all ears stayed intact till data collection was over. It was also observed that very few incidence of lodging occurred in the 2nd season 1983 which was associated with subterranean termites infestation on roots and parts of stalk just above the soil surface. The lodged plants were splitted as earlier, but the confirmation of lodging was not due to stalk breakage of larval tunneling.

Although this preliminary test was carried out for two years, the performance of the hybrids, as subjected to infestation by the natural field population of the borers, was good. It is noteworthy to mention that Basedow^[19] reported that the field evaluation of plant material for resistance under natural or artificial infestations is subjected to environmental interactions between the host plant and the insect pest species which may be difficult to control. Furthermore, Gallun *et al.*^[12] concluded that the critical assessment of resistance may be hindered by fluctuations in the population density of the insect and the effect of environment on both the insect and the host plant.

Finally, it could be concluded that the exotic hybrids CI 31 A and Oh 43 produced impressive results when compared with the local variety from Jizan area. Also with the current expansion in cereal production, more critical studies could be carried out to determine adaptation and degree of hybrid tolerance coupled with artificial rearing and infestation of stem borers from native indigenous species collected from natural infestation.

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الاستجابة المبدئية لهُجن الذرة الشامية المستوردة والصف المحلي للإصابة الطبيعية بنوعين من ثاقبات السيقان النباتية

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أجريت تجربة حقلية بمزرعة كلية الزراعة (ديراب) ، جامعة الملك سعود ، لتقويم الاستجابة المبدئية لثلاثة هُجن مستوردة وصف محلي من الذرة الشامية ، بعد زراعتها وتعرضها للإصابة الحقلية الطبيعية لنوعين من ثاقبات السيقان النباتية هما ثاقبة سيقان الذرة (*Sesamia cretica* Led.) وثاقبة سيقان الذرة الشامية الأوربية *Ostrinia nubilalis* (Hub.) European corn borer .

أوضحت النتائج أن هناك فروقاً معنوية (1٪) بين الهُجن المستوردة والصف المحلي اعتماداً على عدد الكهيفات (cavities) التي تحدثها يرقات هذه الثاقبات داخل سيقان نباتات الذرة . كما لم تُظهر النتائج فروقاً معنوية بين الهُجن المستوردة والصف المحلي فيما يتعلق بعدد اليرقانات التي تم جمعها عند تشريح كل نبات ، أو بعدد الكهيفات التي أحدثتها هذه الثاقبات في قصبات كيزان الذرة (ear-shanks) أو بكل من تفاعلات الهُجن والصف المحلي مع الموسم (السنة) .

واعتماداً على معدل قياس التغذية على الأوراق leaf-feeding rating ، فقد أوضحت الدراسة أن درجة مقاومة الهُجن المستوردة والصف المحلي للإصابة بهذه الثاقبات تتراوح ما بين مقاومة عالية ، ومقاومة ، ومقاومة متوسطة من حيث ضررها واغتداؤها على الأوراق . كما أظهرت النتائج أن هناك درجة ارتباط عالية ($r = 0.8$) بين عدد اليرقات التي تم الحصول عليها عند تشريح النبات في طور الدوارة (whorl stage) وعدد الفراغات التي تم تسجيلها من كل ساق وأخيراً ، فإن الهُجن المستوردة Oh 43 و Cl 31A قد أثبتت تفوقاً واضحاً على الصف المحلي .