Scanning Electron Microscope (SEM) of Leaf Cell Morphology and Inheritance for Corn Leaf Aphid (CLA) Resistance in Maize

Hee-chung Ji
National Institute of Animal Science, South Korea

Joung-kyong Lee
National Institute of Animal Science, South Korea

B. R. Sung
National Institute of Animal Science, South Korea

K. Y. Kim
National Institute of Animal Science, South Korea

K. J. Choi
National Institute of Animal Science, South Korea

See next page for additional authors

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H . C . Ji , J . K . Lee , B . R . Sung , K . Y . Kim , K . J . Choi , K . B . Lim , W . H . Kim , S . Seo
Grassland & Forages Division , National Institute of Animal Science , RDA , Cheonan , Chungnam 330-801 , Korea ,
E-mail xornhc@rda .go .kr

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Introduction Corn Leaf Aphid (CLA) was first named *Aphis maidis* by Fitch (1856) and later given the scientific name *Rhopalosiphum maidis* Fitch . It is one of the most abundant species among the twelve species found on maize in the United States (Stoetzel and Miller , 2001) . CLA is considered to have originated in Asia . It occurs throughout the world and is an economically important cereal aphid species in tropical climates (Blackman and Eastop , 1984) . In North America , it migrates annually from south to north (Kieckhefer et al . , 1974) . CLA infestations can be influenced by environmental factors such as the plant densities and N_2 level of the host . Ali and Ahmed (1996) found that CLA infestation increased with higher plant densities and host N_2 content in wheat . Temperature is probably the most important environmental variable influencing rates of aphid development and reproduction . Corn leaf aphids can cause occasional yield loss of maize . We have observed genetic resistance to the aphid species . An improved artificial inoculation technique with hairpin clip cages was devised . The purposes of this study were to develop manual infestation techniques and quantification methods for screening aphid resistance in tropical maize and to study the leaf cell morphology and to apply the techniques in field trials .

Materials and methods A cross was made between resistant inbred , Hi3871 and susceptible inbred , Hi27 . A total of 177 plants from the two parents , F_1 , F_2 and backcrosses were manually infested with three wingless aphids per cage . Aphid population increase was classified on a ten-point scale based on aphid density inside the clip cage .

Results Average ratings of resistant and susceptible parents were 1 .8 and 6 .6 , respectively . The average F_1 rating (6 .1) was not significantly different from that of the susceptible parent . Phenotypic variance contained 43 .5% additive genetic variance , 20 .1% dominance genetic variance , and 36 .2% environmental variance . The minimum number of effective factors or gene loci was 0 .91 , suggesting that a major gene may be responsible for the resistance . Resistance to CLAs from Hi38-71 appeared to be monogenic and recessive . Trichomes were found on the leafs of Hi38-71 plants and the surface cells were flat shaped . However , epidermal surfaces of Hi27 leaf were rough like a woolly surface , circular and uniform in size and pattern . The cell wall contents of Hi3871 leaf were higher in Acid Detergent Fiber (ADF) , Neutral Detergent Fiber (NDF) , *In Vitro* Dry Matter Digestibility (IVDMD) than Hi27 leaf except Crude Protein (CP) .

Table 1 *Cell wall contents of corn leaf in Hi3871 and Hi27 .*

Varieties	CP*	ADF*	NDF*	IVDMD*
	%			
Hi3871	8 .18	43 .11	69 .61	54 .43
Hi27	10 .43	34 .70	65 .00	42 .76

* CP : Crude protein , ADF : Acid detergent fiber , NDF : Neutral detergent fiber , IVDMD : *In vitro* dry matter digestibility

Conclusions Resistance in Hi3871 was not completely toxic to the species but suppressed aphid increase in the clip cage . Narrow-sense heritability was quite high and rapid genetic gain could be possible with selection on data from the clip cage method . A classic backcross with selfing and screening would be an appropriate breeding method .

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