Differences in Net Apparent Photosynthetic Rates and Chlorophyll Content Among and Between *Cucumis anguria* var. *anguria* and var. *longipes* Meeuse.

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The gherkin, *Cucumis anguria* var. *anguria* Meeuse, produces an abundance of fruit which can be prepared in several ways to provide a source of nourishment. In the West Indies and Brazil young fruits are consumed directly, pickled or prepared as a popular soup "maxixada" (1,5). Although originally thought to be native to the Americas, sexual compatibility and electrophoretic studies indicate that the gherkin is descended from a non-bitter mutant of the African *C. anguria* var. *longipes* Meeuse (2,4). It was introduced into South America (Brazil) in the 1600's, and became semi-wild. Ecotypes with a wide range of fruit characteristics now exist (1).

Previously we have reported that electrophoretic polymorphisms exist among and between plant introductions of *C. anguria* var. *anguria* and var. *longipes* (8, and Staub, this issue of CGC). These studies and those of Dane (3) support their classification as conspecific botanical varieties (4,6,7). Moreover, it appears that *C. anguria* var. *longipes* and *C. prophetarum* L. are closely related (personal communication, A. P. M. den Nijs, 1985).

Since both biochemical and morphological differences exist among these closely related cross-compatible *Cucumis* species, a survey was designed to assess differences in apparent photosynthetic activity. If consistent differences exist, then there would be an opportunity to investigate the genetic and physiological nature of this variation.

Thirty-day-old seedlings of 3 individuals of 10 *C. anguria* var. *anguria* and 3 var. *longipes* accessions were transplanted (3 x 3 m spacing) on 6/1/1984 to a field nursery at Arlington, Wisconsin. Of the 10 *C. anguria* var. *anguria* collections, 5 were of Iranian origin and 5 came from African or South American sources. Plants were grown to maturity under standard cultural practices used for cucumber (*C. sativus* L.). The apparent photosynthetic activity of 2 fully expanded mature leaves from one plant of each series was measured eight times on at least 2 clear days beginning 8/14/1984 with a portable photosynthesis apparatus (LI 6000). The LI 6000 (Li-Cor, Inc., Lincoln, Nebraska) consists of a battery powered non-dispersive infra-red gas analyzer, a porometer, a communications device, and a dedicated datalogger with a maximum 64K bytes of continuous memory. When a photosynthetically active leaf is enclosed in the instrument's leaf monitoring chamber, CO_2 concentration will decrease as photosynthesis occurs, and water vapor concentration will increase due to transpiration. Knowing the volume of the chamber and the area of the leaf, photosynthetic rate and stomatal resistance can be calculated from changes in CO_2 and air flow needed to maintain constant humidity, and other environmental conditions measured by the instrument. The LI-6000 makes 10 individual measurements over a pre-programed time period (40 seconds in our studies) and uses these values to calculate a mean stomatal resistance and photosynthetic value for each leaf. On the first day of measurement, 3 leaves of each plant were collected from the fourth node from the terminal whorl of a lateral branch for chlorophyll analysis.

Chlorophyll from each leaf was extracted separately in ethanol and measurements of chlorophyll a and b were made on a spectrophotometer at 649 and 665 nM,respectively. For informational purposes, field notes were taken on vegetative characteristics (foliage and fruit) during September.

There was a wide range in mean net apparent photosynthetic rate (0.45 to 0.88 mg CO_2 m^{-1} s^{-1}) and chlorophyll content (a = 4.46 to 7.8 and b = 1.72 to 4.46 mg/g dry weight) among C. anguria var. anguria collections (Table 1). The mean net apparent photosynthetic rate of var. anguria collections from Iran was higher than those of other var. anguria collections taken collectively. While the chlorophyll content was, on the average, lower in Iranian collections, chlorophyll b was higher when compared with other var. anguria accessions. The total chlorophyll content of all var. anguria accessions was similar except for one collection (PI 386029) which was comparatively lower due to low chlorophyll b values. The apparent photosynthetic rate of this plant introduction was not remarkable. Compared to var. anguria collections, the mean net apparent photosynthetic rate was lower and total chlorophyll content higher in leaves of var. longipes. The observed higher chlorophyll content was due to higher values of both chlorophyll a and b.

The data of this preliminary survey suggests that there are gross differences in apparent photosynthetic activity and chlorophyll content among and between anguria var. anguria and var. longipes. This study is being repeated under more stringent conditions in the field and under controlled environment conditions. If these initial results can be verified, then the nature of net apparent photosynthetic activity could be characterized.

Literature Cited

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Table 1. Net apparent photosynthetic rate, chlorophyll content and field notes of *Cucumis anguria* var. *anguria* and var. *longipes* Meeuse.

		Net Apparent Photosynthesis Rate[u] (mg $CO_2 m^{-1} s^{-1}$)						Chlorophyll[v] (mg/g dry wt.)			Field Notes[z]			
											Foliage[w]	Vegetative[x]		Fruit[y]
PI	Source	N^t	$\bar{X}$	SD	Min. Value	Max. Value	$SD_{\bar{X}}$	A	B	A+B	Color	Matte	Branching	Spines
C. anguria var. *anguria*														
147065	Brazil	32	0.79	0.14	0.55	1.13	0.02	6.49	2.54	9.03	3-4	1,5	1,4	3,4,8
196477	Ethiopia	32	0.68	0.35	0.20	1.43	0.06	6.29	1.72	8.01	3-4	3,5	3,6	3,4,9
233646	"	32	0.45	0.18	0.21	0.78	0.05	--	--	--	3-4	3,5	3,7	3,4,9
282442	S. Africa	32	0.47	0.16	0.20	0.82	0.03	7.80	3.78	11.58	1-4	1,5	1,4	3,4,9
320052	Ethiopia	32	0.50	0.20	0.15	0.83	0.04	5.38	2.30	7.68	3-4	1,5	1,6	3,4,9
$\bar{X}$			0.58		0.26	1.00		6.49	2.59	9.08				
SD			0.15		0.16	0.28		0.99	0.86	1.77				
C. anguria var. *anguria*														
386029	Iran	48	0.65	0.14	0.37	0.91	0.02	5.07	1.18	6.25	4	3,5	3.8	3,4,8
386031	"	48	0.63	0.33	0.05	1.50	0.04	5.70	3.73	9.43	2	3.5	3.6	3,4,9
386035	"	48	0.62	0.15	0.33	0.96	0.02	4.46	4.97	9.43	2-4	3,5	3,6	3,5,8
386036	"	48	0.76	0.24	0.35	1.40	0.04	5.79	5.44	11.23	3-4	3,7	4,7	3,4,8
386037	"	48	0.88	0.35	0.33	1.62	0.05	5.80	3.63	9.43	4	3,5	3,6	3,4,8
$\bar{X}$			0.71		0.29	1.28		5.36	3.79	9.15				
SD			0.11		0.13	0.32		0.59	1.65	1.80				
C. anguria var. *longipes*														
249894	Africa	94	0.41	0.16	0.11	0.82	0.02	6.72	2.93	9.65	4	1,7	4,7	3,4,9
249896	"	86	0.37	0.15	0.13	0.78	0.02	6.56	2.90	9.46	4	1,7	1,6	3,4,7
249897	"	80	0.53	0.26	0.10	1.14	0.03	6.95	2.60	9.55	4	1,5	3,6	3,4,7
$\bar{X}$			0.44		0.11	0.91		6.74	2.81	9.55				
SD			0.08		0.01	0.20		0.20	0.18	0.10				

z Taken 12 weeks after transplanting.
y 1 = sharp, 2 = medium, 3 = soft/dull, 4 = many, 5 = few, 6 = none, 7 = short, 8 = long, 9 = medium.
x Vegetative matte: 1 = dense, 2 = sparse, 3 =few, small leaves but very branchy, 4 = many large leaves but few branches, 5 = average size, 6 = above average size; vegetative branching: 1 = many, 2 = few, 3 = average, 4 = thick stems, 5 = average stem thickness.
w 1 = dark green, 2 = yellow green, 3 = cabbage green, 4 = green.
v Average of 3 samples.
u $\bar{X}$ = mean, SD = standard deviation; $SD_{\bar{X}}$ = standard error of $\bar{X}$.
t Observations with 10 sampling times (subsamples) per observation measured over at least 2 days (i.e., 2 days x 2 leaves x 8 measurements = 32). Each observation represents data obtained from one mature fully expanded leaf.