RESULTS

The data on influence of potassium chloride, ATP and ADP were presented in table 1. The stomatal responses to KCl, ATP and ADP in buffer were followed from 8 A.M. to 4 P.M. both in light and darkness. The stomatal movements in buffer alone were taken as control. From the table 1, it is clear that the stomatal opening was higher in light than in darkness. KCl enhanced the stomatal opening in light and in 100 mM KCl solutions maximum pore siz e was observed.

Similarly, both ATP and ADP enhanced the stomatal opening over control in both light and darkness. It is interesting to note that maximum stomatal pore size in darkness was observed in 1 mM ADP solution. This may be due to the enhanced oxidative phosphorylation.

In order to understand the role of photosystem II in stomatal movements, influence of PSII electron acceptpos and donors on the stomatal movements was studied.

Table 2 indicates the response of stomatal to potassium ferricyanide, an electron acceptor of PSII, on stomatal movements of Vigna in light and darkness. In

Table 1 Influence of KCl, ATP and ADP on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness. (pore size in μm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	2.2	4.3	4.3	3.7	2.7
KCl					
10 mM		5.4	6.5	2.7	2.7
50 mM		7.5	9.7	4.3	2.7
100 mM		8.7	10.8	5.9	3.7
ATP 1 mM		7.5	8.6	5.9	5.9
ADP 1 mM		8.6	8.6	8.0	6.5

Table 2 Influence of potassium ferricyanide on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness.
(poor size in μm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	2.2	4.3	4.3	3.2	3.2
Potassium ferricyanide					
10 mM		Closed	Closed	Closed	Closed
10 mM		Closed	Closed	Closed	Closed
1 mM		2.5	2.5	Closed	Closed

the presence of potassium ferricyanide, the stomatal opening was totally inhibited both in light and darkness. A little opening was observed in 1 mM potassium ferricyanide solutions in light. The inhibition in stomatal opening may be due to the inhibitory effect of ferricyanide.

The data in table 3 indicate the influence of different concentrations of hydroxylamine hydrochloride, an electron donor of PSII on stomatal movement. As evident from the table, hydroxylamine hydrochloride enhanced the stomatal opening in light over control. However in darkness, it showed little effect and the opening was similar to that of control. Maximum stomatal opening was observed in 1 mM solution in light.

Table 4 indicate the data on the influence of $MnCl_2$, an electron donor of PSII on stomatal movement. Similar to hydroxylamine hydrochloride, stomatal opening was enhanced by $MnCl_2$ over control in light. In darkness, after 4 hours of incubation, a slight stimulation in stomatal opening was observed in 1mM $MnCl_2$ solutions.

The data on the influence of sodium ascorsbate, an electron donor of PSII on stomatal movements was presented

Table 3 Influence of hydroxylamine hydrochloride on the stomatal movements in isolated epidermal strips of *Vigna unguiculata* in light and darkness (pore size in µm)

Treatment	Initial	Light		Darkness	
	8 A.M.	12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	5.4	7.0	7.0	5.9	5.9
Hydroxylamine hydrochloride					
10 µM		8.0	7.5	5.9	5.9
100 µM		8.0	7.5	5.9	5.9
1 mM		9.1	9.5	5.9	5.4

Table 4 Influence of different concentrations of $MnCl_2$ on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness (pore size in µm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	5.4	7.0	7.0	5.9	5.9
$MnCl_2$					
10 µM		8.0	8.0	5.9	5.4
100 µ M		8.6	8.6	5.4	5.4
1 µM		9.6	9.6	7.0	5.9

in table 5. Sodium ascorbate enhanced the stomatal opening slightly at high concentrations. Only in 0.5 and 1 mM concentrations, a slight stimulation in stomatal opening was observed. In darkness in high concentrations, sodium ascorbate was found to be inhibitory.

Table 6 presents the data on the influence of sodium ascorbate, and diphenyl carbazide, the electron donors of PSII, on stomatal movements. Both PSII donors enhanced stomatal opening in light. A slight enhancement was observed in sodium ascorbate solutions.

In table 7, the influence of ATP, ADP, ATP $MnCl_2$ and ADP + $MnCl_2$ on stomatal movements was presented. As reported earlier, both ATP and ADP enhanced the stomatal opening. Similarly ATP + $MnCl_2$ and ADP + $MnCl_2$ also enhanced stomatal opening both in light and darkness. The enhancement in light is greater than the enhancement in darkness.

In table 8, the data were presented on the influence of $MnCl_2$, $MnCl_2$ + NADP, hydroxylamine hydrochloride and Hydroxylamine hydrochloride + NADP on stomatal movements. Both $MnCl_2$ alone and $MnCl_2$ + NADP enhanced the stomatal

Table 5 Influence of different concentrations of sodium ascorbate on stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness

(pore size in μm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	5.4	7.0	7.0	5.9	5.9
Sodium ascorbate					
10 μM		7.0	7.0	5.8	5.8
100 μM		7.5	8.6	4.8	4.3
1 mM		8.0	7.0	4.3	4.3

Table 6 Influence of sodium ascorbate and diphnyl carbazide on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness

(pore size in μm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	3.2	4.3	4.3	4.3	4.3
Sodium ascorbate					
0.5 mM		7.5	8.6	4.8	4.3
Diphenyle carbazide					
1 mM		5.4	5.4	3.7	3.2

Table 7 Influence of ATP and ADP, ATP + $MnCl_2$ and ADP + $MnCl_2$ on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness (pore size in μm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	2.2	3.2	4.3	3.2	3.2
ATP 1 mM		7.5	8.6	5.9	5.9
ADP 1 mM		8.6	8.6	8.0	6.5
ATP + $MnCl_2$		8.6	10.7	6.5	6.5
ADP + $MnCl_2$		8.0	8.0	6.5	6.5

Table 8 Influence of $MnCl_2$ $MnCl_2$ + NADP, hydroxylamine Hydraxylamine + NADP on the stomatal movements in the isolated epidermal strips of Vigna unguiculata in light (pore size in μm)

Treatment	Initial 8 A.M.	Light	
		12 Noon	4 P.M.
Buffer	3.2	6.5	6.5
$MnCl_2$ mM		8.6	8.6
$MnCl_2$ + NADP		9.6	9.6
Hydroxylamine hydrochloride		8.6	8.6
Hydroxylamine hydrochloride + NADP		9.6	8.6

opening in light. The enhancement in stomatal opening was more in $MnCl_2$ + NADP than in $MnCl_2$ alone. A similar observation was made in hydroxylamine hydrochloride and hydroxylamine hydrochloride + NADP. This clearly indicates the participation of PSII in stomatal opening.

The data on the influence of various organic acid intermediates of Kreb's Cycle were presented in table 9. The pyruvate, citrate and succinate enhanced the stomatal opening both in light and darkness. The enhancement was more in light than in darkness. This may be due to the participation of energy generated from both photophosphorylation and oxidative phosphorylation in light. Further these organic acids may have contributed to the increased osmotic opening of stomata.

The influence of DCMU, an inhibitor of photosynthetic electron transport and DNP, an inhibitor of both oxidative and photophosphorycation was studied and the data were presented in table 10. DCMU, an inhibitor of electron flow between Q and Cyt. b_{559}, was found to have little effect on stomatal opening at 0.1 mM concentration. But at high concentrations of 1mM DCMU inhibited the stomatal opening both in light and darkness. But the inhibition

Table 9 Influence of citrate, pyruvate, succinate on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light (pore size in μm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	5.4	8.0	8.0	7.5	7.0
Sodium citrate 1mM		9.7	9.5	8.0	7.5
Sodium pyruvate 1mM		9.1	9.1	7.5	7.5
Sodium succinate 1 mM		8.6	9.1	8.0	7.5

Table 10 Influence of DCMU and DNP on the stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness (pore size in µm)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	5.4	8.6	8.6	6.5	6.5
DCMU					
0.1 mM		7.5	7.5	6.5	6.5
1.0 mM		4.3	4.3	5.4	5.4
DNP					
0.1 mM		3.2	3.2	2.2	2.1
1.0 mM		2.2	2.2	1.0	1.0

was more in light than in darkness. Since DCMU is an inhibitor of PSII mediated photosynthetic electron transport, from the above, it may be stated that PSII has a role in stomatal opening.

DNP, an inhibitor of cyclic and oxidative phosphorylations, inhibited the stomatal opening in both light and darkness. The inhibition is more in darkness than in light.

The data in table 11 indicate the response of stomata to ABA in light and darkness. ABA inhibited the stomatal opening in both light and darkness. In 10 uM concentration a little opening was observed in light. However, at higher concentration of ABA, inhibition was more pronounced.

Table 11 Influence of different concentrations of ABA on stomatal movements in the isolated epidermal strips of *Vigna unguiculata* in light and darkness (pore size in um)

Treatment	Initial 8 A.M.	Light		Darkness	
		12 Noon	4 P.M.	12 Noon	4 P.M.
Buffer	5.4	8.6	8.6	6.5	6.5
ABA					
10 µM		4.3	3.7	1.6	1.0
100 µM		1.0	1.0	1.0	1.0
1 mM		1.0	1.0	Closed	Closed