stoffaufnahme je Einheit an gesamter Zellsubstanz wäre daher $\Delta Z/Z\Delta t$ ein Mass für die «relative Zuwachsgeschwindigkeit» (Zellwandzuwachs je Zellwandmasse und Zeiteinheit). Da jedoch die Aufnahme an $^{14}CO_2$ von der Wachstumsphase abhängt, wurden die Werte durch Berücksichtigung der Aktivität der Einheitsmasse an Zellsubstanz normalisiert (Figur 1).

Der Anstieg bis zur 20. Zyklusstunde beruht offenbar auf der Neusynthese der Zellwand nach erfolgter Teilung. Die Kurve konnte mit einer analogen Kurve für den freien Raum (V) als Funktion der Wachstumsphase verglichen werden. Der freie Raum vom *Chlorella* war nämlich nach einer Isotopenverdünnungsmethode bestimmt worden[14]. Wird der freie Raum als das zugängliche Volumen der Zellwand interpretiert, so kann aus der Grösse des freien Raums in Abhängigkeit von der Wachstumsphase die «relative Zuwachsgeschwindigkeit des freien Raums» ermittelt werden ($\Delta V/V\Delta t$). Die ursprüngliche wie auch die jetzt in dieser Weise abgeleitete Kurve sind der Figur 2 zu entnehmen.

Die annähernde Kongruenz der beiden Kurven in den Figuren 1 und 2b (Konstanz des Verhältnisses der relativen Zuwachsgeschwindigkeiten von Zellwandmasse bzw. -volumen) zeigt, dass der freie Raum je Einheitsmasse an Zellwand während des Wachstumszyklus von synchroner *Chlorella* in Licht und Dunkel konstant bleibt. Die derart definierte «Porosität» der Zellwand ist also bei jungen und alten Zellen etwa die gleiche.

Eine ähnliche Periodizität wie die Masse und der freie Raum der Zellwand zeigt der Stickstoffgehalt der Zellwand (Figur 3). Nach Abbauversuchen mit dem proteolytischen Enzympräparat Pronase an Wänden von lebenden Zellen in verschiedenen Zyklusstadien scheint es sich dabei mindestens teilweise um Proteinstickstoff zu handeln[15]. Eine Deutung ist nicht evident, solange die Rolle der Proteine innerhalb der pflanzlichen Zellwand zweifelhaft ist[16].

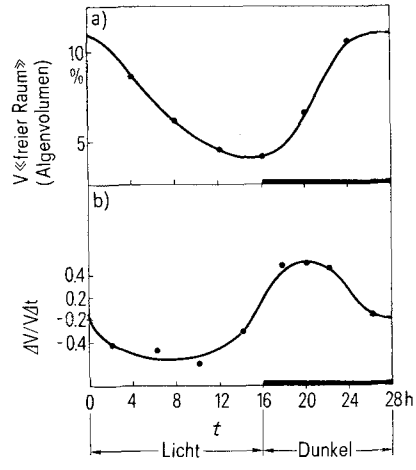

Fig. 2. Freier Raum von synchroner *Chlorella*. a) Grösse des freien Raums (Prozent des Zellvolumens). b) Relative Zuwachsgeschwindigkeit des freien Raums.

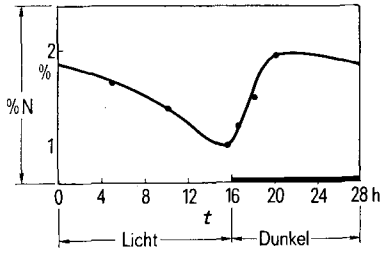

Fig. 3. Stickstoffgehalt der Zellwand synchroner *Chorella*.

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Low Pressure Storage of Seeds

E. C. Lougheed, D. P. Murr, P. M. Harney and J. T. Sykes[1]

Horticultural Science Department, University of Guelph, Guelph (Ontario N1G 2W1, Canada), 1 March 1976.

Summary. Storage of celery, cabbage and onion seed for 14 weeks under conditions of reduced atmospheric pressure decreased the deleterious effects of high temperature and high relative humidity upon the germination of these short-lived seeds.

The effects of storage in a partial vacuum upon seed viability have not been pronounced[2-4], although results of recent experiments with high moisture feed grains stored under reduced pressure in static or semistatic systems have been encouraging[5,6]. The new technique of low pressure storage (LPS) differs from that previously used for seed storage (sealed chambers or packages) in that there is constant air exchange. LPS conditions modify

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Percent germination of some vegetable seeds after low pressure storage for 14 weeks at 26.5 °C under 'wet' and 'dry' conditions

Storage treatment (mm Hg/RH)[a]	Days from start of germination						
	9	11	13	3	4	4	5
	Celery			Cabbage		Onion	
740/20 ± 5%	50.3 a[b]	60.3 a	65.8 a	84.3 a	94.1 a	81.9 a	83.4 a
'Dry'							
730/20 ± 5%	49.9 a	70.5 a	72.0 a	91.0 ab	92.2 a	56.8 b	72.0 a
380/10 ± 2.5%	58.3 a	71.9 a	78.6 a	83.8 a	87.8 a	76.7 ab	82.1 a
70/ 2 ± 0.5%	66.1 a	78.4 a	83.8 a	88.4 a	90.0 a	43.2 b	62.3 a
'Wet'							
730/80 ± 5%	3.4 b	15.1 b	15.1 b	16.6 c	28.1 b	0.0 c	0.0 b
380/40 ± 2.5%	59.3 a	64.4 a	69.8 a	97.2 b	98.8 a	65.1 ab	85.1 a
70/ 8 ± 0.5%	62.8 a	79.0 a	83.8 a	95.0 ab	97.7 a	68.5 ab	87.0 a

[a] Calculation based on relative humidity at 730 mmHg lowered by appropriate reduction in atmospheric pressure. [b] Means not suffixed by the same letter are significantly different at $p = 0.05$ using Duncan's Multiple Range Test. The data were transformed using the inverse sine transformation and means are detransformed. Percent germination prior to treatment for celery, cabbage and onion was 90, 95 and 90, respectively.

the storage environment through removal of volatiles and lowering of the partial pressure of enclosed gases including that of water vapour, thus decreasing the RH[7]. Therefore, LPS could influence seed viability through: a) the removal of volatiles such as ethylene which may promote germination[8], b) a lowering of the O_2 tension which has been shown to increase viability[9], or c) control of fungal growth[10] and relative humidity which is known to decrease viability when too high[11]. This paper describes a preliminary investigation into the potential application of LPS for long-term conservation of seed.

Seeds of celery (cv. Florida 683), cabbage (cv. Penn State Ballhead) and onion (cv. Autumn Spice) were obtained from a commercial seed supplier. The seeds were stored for 14 weeks in the dark at 26.5 ± 2 °C in 9 l plastic desiccators under different atmospheric pressures: 740 mm Hg (untreated control, atmospheric pressure, Guelph, Ontario, Canada), 730 mm Hg (low pressure control, just sufficient to retain lids tightly on the desiccators), 380 mm Hg and 70 mm Hg. The low pressures were created and air flow (1/3 air-change per h) maintained by vacuum pumps. The relative humidity of the incoming air to the control was maintained at ambient (20 ± 5%, 'dry') or 80 ± 5% ('wet') through use of a humidifier. The humidity of the incoming air under low pressure treatments was reduced approximately in proportion to the reduction in atmospheric pressure.

Seeds were germinated between moistened filter paper in petri dishes and given a 12-h photoperiod at 26.5 °C. There were 3 replicates, each containing 20 seeds. The data presented are for the 1st day on which there was an adequate percentage germination to permit treatment comparisons, and for the day prior to that one on which percentage viable seedlings began to decrease due to mold, desiccation or other causes. With celery, data for an intermediate day are presented because of its long germination period.

The most striking effect observed was the significantly higher percentage germination of seeds which had been stored under reduced pressure and 'wet' conditions compared to those seeds stored at 730 mm Hg and 'wet'. No significant differences in seed germination could be observed among the 'dry' treatments. However, in general, those seeds which had been stored at 70 mm Hg under 'wet' or 'dry' conditions germinated the best. The data for celery suggest that as the storage pressure is reduced the percentage germination increases. This trend is not as evident in the cabbage or onion data. There was also an indication that the 730 mm Hg and 'wet' treatment delayed germination. However, it may have been that this treatment decreased the number of germinable seeds which would show up as an apparent delay in germination.

LPS is an effective method for modification of the storage atmosphere, although modification of atmospheric composition usually has not been very effective in seed storage[3]. More recent results with seeds of onion and lettuce[12], and barley, bean and pea[9] provide convincing evidence that a decrease in O_2 tension in the storage atmosphere markedly increases seed viability. The failure in the present experiment to find consistent significant differences between 740 mm Hg or the 730 mm Hg-'dry' treatments compared to the reduced pressure and 'dry' treatments ostensibly indicates that the lowered partial pressure of O_2 (approximately 0.5 normal for 380 mm Hg and 0.1 normal for 70 mm Hg or the approximate equivalent of 10% and 2% O_2, respectively) had little effect. However, comparisons based on O_2 level alone are difficult since the RH at the reduced pressure is also lowered proportionally to the drop in pressure.

We believe, therefore, that the observed effect on germination was due to control of RH by LPS rather than the reduced O_2 level. Maintenance of low RH has been shown to be an effective aid in maintaining seed viability even at high temperatures[4]. One advantage of LPS with constant air exchange over sealed chambers or canisters is that LPS provides a method of controlling the RH within the limits imposed by the RH of the incoming ambient air, whereas the RH in sealed containers is the equilibrium RH between the seeds and the enclosed atmosphere. Furthermore, LPS conditions could be effective in drying seeds to the percentage moisture re-

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quired for long-term storage. However, considerable care would be necessary to ensure that the environment does not become too dry for seed stored on a long-term basis.

The large variability between replications due to the small number of seeds used in this experiment often resulted in failure to find statistically significant differences between means with large numerical differences. However, similar results were obtained with cabbage and onion seed in another trial, as well as after a 7-week storage period in this investigation. The differences noted in this paper clearly indicate a beneficial influence of LPS upon short-lived seeds. Further research on the application of LPS to long-term conservation of seeds is clearly required.

Transmission expérimentale d'un facteur responsable de l'intersexualité des mâles chez *Orchestia gammarellus* (Pallas)

Experimental Transmission of a Factor Responsible of Male Intersexuality in *Orchestia gammarellus* (Pallas)

T. Ginsburger-Vogel et M. C. Carré-Lecuyer

Laboratoire de Biologie et Génétique évolutives du C.N.R.S., F–91190 Gif-sur-Yvette (France); et E.N.S., F–92210 Saint-Cloud (France), 16 février 1976.

Summary. Grafts of male-intersex or thelygenous female organs induce oostegit development in normal males. The factor responsible of this intersexuality is experimentally transmissible. It is not strictly specific; it can provoke the appearance of oostegits in males of *Talitrus saltator* and *Orchestia cavimana.*

L'intersexualité des mâles, observée dans certaines populations de l'amphipode *Orchestia gammarellus* (Pallas) a été reliée à des anomalies de la proportion des sexes[1,2]: il existe des femelles dont la descendance est constituée d'une majorité de femelles (80 à 85%) lorsqu'elles sont élevées et croisées à 17 °C. Les mâles issus de ces femelles thélygènes sont, en règle générale, intersexués; ils sont caractérisés par la possession d'oostégites et de gnathopodes anormaux, à lobe juvénile persistant[3]. Chez *Orchestia gammarellus*, ces anomalies sont thermosensibles dans la plupart des lignées[4]. Elles persistent dans les élevages maintenus à 17 °C et disparaissent totalement à 22 °C.

La démonstration du mode de transmission matrocline de la thélygénie et de l'intersexualité[2,5] nous a conduit à émettre l'hypothèse de l'existence d'un facteur féminisant thermosensible qui serait responsable de la thélygénie des femelles et de l'intersexualité des mâles. Par des expériences d'implantation ou d'injection de broyats d'organes, nous avons cherché à savoir si ce facteur peut être transmis à des mâles normaux, c'est à dire si l'on peut induire chez ceux-ci l'apparition d'oostégites. Un résultat positif constituerait un puissant argument en faveur de l'existence et de la nature infectieuse de l'agent féminisant.

Matériel et méthodes. Divers organes ou broyats d'organes de mâles intersexués (testicules, glandes androgènes, muscles, hémolymphe) et de femelles thélygènes (ovaires) sont implantés ou injectés dans des mâles normaux de même espèce (implantations homospécifiques). Des implantations hétérospécifiques ont été réalisées chez *Orchestia cavimana* et *Talitrus saltator*. Les implantations d'organes sont réalisées à l'aide de brucelles fines, les injections effectuées avec des seringues Hamilton No 701; 5 à 10 µl de broyat dilué (20 ovaires dans 250 µl d'eau de mer $^2/_3$) sont injectés dans chaque receveur.

Pour chaque série expérimentale, des témoins ont été réalisés en greffant ou en injectant des organes homologues d'individus normaux, afin d'éliminer l'hypothèse d'une influence de l'implantation ou de l'injection. Les opérés sont élevés isolément en enceinte thermostatée à 17 °C.

Résultats. A) Implantations homospécifiques. Le Tableau indique les résultats observés pour chaque type d'implantation ou d'injection.

Nous constatons que des mâles normaux peuvent acquérir des oostégites lorsqu'ils reçoivent des implants provenant de mâles intersexués ou de femelles thély-

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Résultat des implantations ou injections d'organes de mâles intersexués ou de femelles thélygénes dans des mâles normaux.

	Nature de l'organe implanté				
	Glande androgène	Testicule	Muscle	Sang	Ovaire
No. de receveurs	30	27	30	30	31
No. de survivants 4 mois après l'opération	24	24	29	21	31
No. d'individus ayant différencié 1 ou plusieurs oostégites	8	10	10	9	15
Cas positifs (%)	33,3	41,6	34,5	42,8	48,4