荳科飼料作物硬実の鑑別について*

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摘 要

1. 吸水させないで、レンゲの硬実と非硬実を鑑別する方法を知るために実験を行つた。
2. レンゲ種子の吸水部位は種瘤の部分である。
3. 種瘤部の透明度の差異により硬実、非硬実を鑑別できる。即ち、種瘤部の透明なものがあり、白色不透明なものが非硬実である。
4. 硬実が非硬実化するのには、種瘤中央部のヒムが種皮の外側に達するためであり、又透明な種瘤部が不透明化するのには、種瘤内部組織の機械的変化によるものであると考えられる。

On the discrimination of hard seed in some leguminous forage crops

1. Genge (*Astragalus sinicus* L.)

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As the hard-coatedness in seeds of crop plants is an important problem of botany and agronomy, many investigators have hitherto studied this problem. Nevertheless we have even now no general conclusion on why the seed coat prevents the entrance of water in some kinds of plant and on whether this character is hereditary or not.

The authors have entered upon a study of hard seeds in leguminous forage crops from the embryologic ecological point of view (SUETSUGU, 1951). It is necessary first to determine whether a given seed is hard or not. The swelling method has been generally used for that purpose. But it requires many days for a test and accordingly is not suitable for solution of such a problem as how the hard seed coat differs from the soft, the latter being changed in the character through swelling. For the test of unswollen seeds there is known the osmic acid method in *Melilotus alba* (HAMLY, 1932) but it is also objectionable causing transmutation of some parts of seed coat. So the experiments were conducted in the present study, without giving any changes in the seed. It was found as the result that this could be accomplished by examination of the externals of seeds in Genge, hairy vetch and wild soybean, and by measurement of specific gravity in red clover.

In this paper authors describe some points of the results obtained in Genge seed.

Water absorbing part of Genge seed :

Ripened Genge seed absorbs water through the strophiole located about the hilum (Fig. 1). This is proved from the fact that soft Genge seed does not swell when the strophiole is sealed with paraffin and soaked in water.

The strophiole as shown in Fig. 2, has a thicker pallisade layer and is without epitherial layers differing from the other part of seed coat, and the pallisade cells contain no tannin except in the middle part of the strophiole.

Fig. 1 Difference in transparency of the strophiole in Genge seed

A: side view S: strophiole B: hard seed C: soft seed

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Fig. 2 Internal form of the strophiole

left : cross section right : longitudinal section
 p : pallisade layer e : epitherial layer
 pr : parenchyma c : cotyledon

Discrimination of hard and soft seed by inspection of the transparency of the strophiole :

Microscopical observation of the strophiole with magnification of fifty times proved that the transparency of the strophiole differed among seeds, and accordingly we could classify the seeds into three groups, viz. (a) transparent all over the strophiole, (b) opaque except the central part of the strophiole and (c) middle in transparency. We placed seeds on pieces of moist filter paper and studied the relation between transparency and hard-coatedness.

Table 1 and 2 show the results.

Table 1. Relation between hard-coatedness and transparency of the strophiole in Genge seeds (I)

Transparency of strophiole	Number of seeds used	Number of seeds swelled											Total	% of Hard seed
		Days after setting												
		1	2	3	4	5	6	7	8	9	10			
a	30	0	0	0	0	0	0	0	0	0	0	0	100	
b	30	29	1	-	-	-	-	-	-	-	-	30	0	
c	30	26	0	2	2	-	-	-	-	-	-	30	0	

Note i) a : transparent all over the strophiole ,
 b : opaque except the central part of the strophiole
 c : middle in transparency
 ii) Expt. was made at 23°C

Table 2. Relation between hard-coatedness and transparency of the strophiole in Genge seeds (II)

Transparency of strophiole	Number of seeds used	Numbes of seeds swelled											Total	% of Hard seed
		Days after setting												
		1	2	3	4	5	6	7	8	9	10			
a	100	0	0	0	0	0	0	0	0	0	0	0	100	
b	100	99	1	-	-	-	-	-	-	-	-	100	0	
c	26	18	7	0	1	-	-	-	-	-	-	26	0	

Note : Same as in Table 1.

From these results it is evident that the seeds having transparent strophioles were hard and the opaque ones soft.

Difference between hard and soft seed in internal form :

Pallisade layer, parenchyma, and cotyledons stick tightly together at the strophiole in hard seeds, but in the soft they separate each other.

Change in transparency of the strophiole by fluctuating temperatures :

NAKAJIMA (1933) reported that hard Genge seed lost their hard-coatedness by the fluctuating temperatures from 30°C to 17°C and TAKAHASHI (1938) found the same fact from 40°C to 20°C. The present authors also treated the hard Genge seed with fluctuating temperatures from 40°C to 20°C and found that the transparent strophiole became opaque by this treatment.

From the facts described above, it is known that the inversion of seed from hard to soft is due to the change in tissue of the strophiole and the discrimination of hard and soft seed can be made externally by inspection of transparency of the strophiole.

Mechanism of softening :

From these results, authors suppose that the mechanism of softening may be as follows : When the seed ripens there is performed a rift at the pallisade layer of the strophiole from the light-line centripetally. In this period, the strophiole is transparent all over the surface

and the seed does not absorb water as the rift does not extend to the outside of seedcoat. By fluctuating temperatures causing disparity in expansion of the tissues the rift reaches the outside of seed coat and the strophiole becomes opaque owing to mechanical changes of that tissue, and then, the seed absorbs water.

Literature

1. CROCKER, W.: Dormancy in seeds, *Growth of plants*, 67-138, Reinhold Pub. Co. New York, 1948.
2. HAMLY, D. H.: Softening of the seeds of *Melilotus alba*, *Bot. Gaz.*, **93** : 345-375, 1932.
3. ICHIJIMA, K.: Studies on the hard seed of *Astragalus sinicus* L., *Jour. Sapporo Soc. Agric. Forest.*, (I) **38** : 435-447, 1917, (II) **39** : 1-32, 1917 (In Japanese).
4. KONDO, M.: Untersuchungen über harte Samen von *Astragalus sinicus* die in 17 bzw 18 Jahre lang unter Wasser nicht gequollen hatten, besonders über die Vererbungsverhältnisse dieser Hartschaligkeit, *Ber. Ohara Inst. Landw. Forsh.*, **7** : 321-328, 1936.
5. MIZUNO, T.: The effect of fertilizer elements on the percentage of hard seeds of Genge, *Agric. Hortic.*, **7**(5) : 891-902, 1932 (In Japanese).
6. NAKAJIMA, Y.: Hard seed problems of Genge, *Agric. Hortic.*, **7**(6) : 1049-1065, 1932 (In Japanese).
7. NAKAJIMA, Y.: Some experiments on swelling and germination of Genge seed, *Proc. Crop Sci. Jap.*, **5**(4) : 443-459, 1933 (In Japanese).
8. OHGA, I.: A study of the ancient but still viable fruit of the Indian lotus found in peat bed near Pulantien, South Manchuria. *South Manchurian Railway Co. Sect. Agric. Pub.*, **27** : 1-107, 1929.
9. SUETSUGU, I.: Developmental morphology of the embryo in barley, rye, and oats, *Bull. National Inst. Agric. Sci. Series D*, **1** : 47-87, 1951.
10. TAKAHASHI, R.: Relation between temperature and water absorption of Genge seeds, *Nogakukenkyn* **30** : 111-131, 1938 (In Japanese).
11. YAMAMOTO, Y. and SAITO, E.: Studies on the Genge seeds, *Agric. Hortic.* (I) **8**(5) : 1166-1180, (II) **8**(6) : 1410-1420, (III) **8**(7) : 1602-1612, 1933 (In Japanese).