protected leaves, there is in the experiments described above no evidence that such a condition obtains.

In order to fulfil the requirements of the accepted hypothesis, it is necessary to postulate that sufficient virus is present to afford protection to the apparently healthy leaves, but insufficient for transmission by the technique employed. The probability of such a condition occurring is minimized by the finding of other workers (*3*) that the dilution end point of this virus lies beyond 10^{-5}. However, from the known data, it is difficult at the present stage of the investigation to suggest any plausible alternative explanation for the phenomena described.

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An Interspecific Cross Involving the Lima Bean *Phaseolus lunatus* L.[1]

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The presentation of this brief account of preliminary success in the crossing of the Lima bean *Phaseolus lunatus* L. with the native wild thicket bean *P. polystachyus* (L.) B. S. P. may provide bean breeders with an incentive to investigate further the possible contributions of this native source of germ plasm to any Lima-bean breeding program.

The cross *P. polystachyus* ♀ × *P. lunatus* ♂ was attempted an estimated 50 times with no success, but an estimated 100 attempts to effect the reciprocal cross resulted in the production of seven F_1 plants for which there is objective evidence that these are bona fide hybrids, although none of the plants has yet matured to the point of flower and seed production.

All the hybrids expressed completely or nearly completely the hypogaeal germination habit of the staminate, *P. polystachyus* parent. In two out of the seven a tendency toward the epigaeal habit of the pistillate parent was expressed by the slight elevation of the cotyledons to a level barely above the surface of the soil. With deeper planting this might even have escaped observation. In a Lima control the cotyledons were elevated to a height of 3 in. (Fig. 1).

One of the hybrids has as its pistillate parent a Lima selection resembling the commercial variety Fordhook. The Lima parent of the other six F_1 hybrids is itself an F_1 hybrid from a cross between a Fordhook-type selection and line M-270 from O. W. Norvell. M-270 is a small-seeded, colored-flowered, short-day, wild, viny type with a strong perennial tendency.

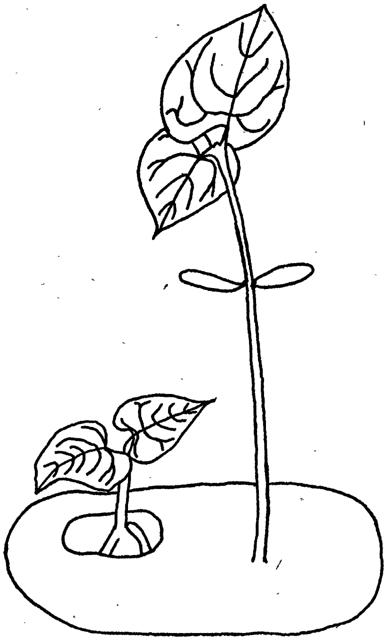

Fig. 1. Emergence behavior of *P. lunatus* × *P. polystachyus* F_1 hybrid (left) compared to that of *P. lunatus*. Soil removed to show hypogaeal position of the cotyledons of the hybrid. (Line drawings traced from a photographic negative.)

The principal objective of the *P. lunatus* × *P. polystachyus* cross has been to incorporate into the former species the hypogaeal germination habit of the latter in an attempt to solve the emergence problem in Limas, where a high mortality among seedlings is likely to result from the breaking of the hypocotyl ("neck-breaking") as it elongates in an often unsuccessful effort to push the extremely large Lima cotyledons through an encrusted or impacted soil. In *P. polystachyus* and several other bean species elongation of the stem of the plant involves only the development of the epicotyl and the plumule, and the cotyledons remain at planting depth because of the absence of elongation of the hypocotyl.

Apart from consideration of this one obviously valuable germination character is the possibility that a native species, such as *P. polystachyus,* having a comparatively wide geographic distribution, may possess yet unrecognized resistances to diseases and pests and may also possess physiological attributes of survival value. According to Small (*1*), *P. polystachyus* ranges from Florida as far north as Minnesota, Ontario, and Maine and as far west as Texas and Nebraska, so it seems apparent that the perennial rootstock at least has some degree of cold-hardiness even though the plant usually occurs in protected locations.

In view of the consideration that *P. polystachyus* may be a valuable source of germ plasm to bean breeders, that the realization that such a cross is possible may be of interest to taxonomists, and that

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the writer has encountered in the literature no other instance of the involvement of *P. lunatus* in any interspecific hybrid combination, it was deemed advisable to publish now this preliminary report of progress, even though the subsequent breeding behavior of the F_1 hybrids is yet to be established.

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Niacin and Niacinamide Biosynthesis in Insects[1]

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It has recently been shown that niacin can be formed from tryptophan in mammals (*1*), but cannot be formed in the larval stage of insects, such as *Drosophila melanogaster* (*2*), *Tenebrio molitor,* and *Tenebrium confusum* (*3*), which require both tryptophan and niacin in their larval growth.

This paper reports an increase of the amount of niacin and niacinamide during the metamorphosis of the pupal stage in the silkworm *Bombyx mori.* We determined these two substances in various stages of the pupa, which live for a considerable period (7–12 days) without food. Female pupae of the Japanese and Chinese hybrid (J 115 × C 108) were used. The samples were kept at a constant temperature of 28° C.

The determination of niacinamide was made by Kato and Shimizu's method (*4*), and that of total niacin by the microbiologic assay method, using *Lactobacillus arabinosus.*

The results of the experiments are given in Tables 1 and 2 and in Fig. 1. It was found that in the period from the second to the eighth day both the total niacin and the niacinamide reached a maximum on the eighth day, and that the amounts of these substances were twice as great as on the second day. They suddenly decreased on the ninth day. The formation of total niacin was found to be greater than that of niacinamide at each period.

From the above results, we conclude that niacin and niacinamide are formed biosynthetically in silk-

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TABLE 1

TOTAL NIACIN CONTENT OF SILKWORM PUPAE, DETERMINED BY THE MICROBIOLOGICAL ASSAY METHOD WITH *L. arabinosus*

Material and age in days	Wt of 5 fresh pupae (g)	Titration value (ml)	Calibration curve (γ)	Dilution factor	Content of total niacin (γ)	Total niacin content (γ/g)	Total niacin content (γ/individual)
Female pupae							
Second day	7.50	2.55	0.08	3150	252	33.6	50.4
“ “	8.30	2.75	.09	3150	284	34.2	56.8
Fifth “	7.84	2.85	.10	3325	333	42.4	66.6
Sixth “	7.27	3.10	.12	3325	399	54.8	79.8
Eighth “	7.19	3.70	.18	3325	599	83.3	119.8
Ninth “	6.70	3.25	0.14	3588	502	74.9	100.4

TABLE 2

NIACINAMIDE CONTENT OF SILKWORM PUPAE, DETERMINED BY KATO AND SHIMIZU'S METHOD

Material and age in days	Wt of 5 fresh pupae (g)	Titration value (ml)		Niacinamide added (γ)	Dilution factor to total individuals	Niacinamide (γ) in total individuals	Estimated value (γ), titrated with 2γ/ml of niacinamide standard solution		Dilution factor	Recovery (%)	Niacinamide content (γ/g)	Niacinamide content (γ/individual)
		a	b	c	$f =$	$\frac{acf}{b-a}$	a'	b'	f'			
Female pupae												
Second day	7.50	0.080	0.120	10	6.0	120	0.160	0.240	120	96	16.0	24.0
“ “	8.30	.085	.125	10	6.0	128	.170	.250	120	96	15.4	25.6
Fifth “	7.84	.105	.140	10	6.3	189	.210	.280	120	84	24.1	37.8
Eighth “	7.19	.125	.160	10	6.3	225	.250	.320	120	84	31.2	45.0
Ninth “	6.70	0.120	0.162	10	6.3	180	0.240	0.324	120	101	26.8	36.0

a, a', no niacinamide added.
b, b', niacinamide added.

$$\text{Recovery} = \frac{f'\,(b'-a')}{c} \times 100.$$