both sections also failed to support to naturalness of the two sections in the genus *Amaranthus*[5]. On the basis of detailed investigations on interspecific hybrids within sections Amaranthus and Blitopsis, Pal and Khoshoo[6,7] suggested that the speciation within section Amaranthus involved cryptic structural changes of chromosomes and genetic drift whereas within section Blitopsis it was due to translocations involving 4–14 chromosomes. Cytological details of *A. spinosus* × *A. viridis* hybrid do not indicate chromosome repatterning by translocation, because of the absence of multivalent formation in PMCs. On the other hand, cryptic structural differences and genetic drift may be the factors responsible for the distinctness of the two species. Such cryptic differences between chromosomes resulting in genetic imbalance and probably early terminalization of chiasmata because of inadequate homology leading to noncoorientation of participating chromosomes may be responsible for the reduction in pollen fertility of the interspecific hybrid.

28 March 1988

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JAGGERY SOLUTION—A COMPLETE NUTRIENT MEDIUM FOR MULTIPLICATION OF *RHIZOBIUM*

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YEAST-EXTRACT-MANNITOL (YEM) medium is generally used for preparation of *Rhizobium* inoculants. Mannitol and yeast-extract, the two expensive ingredients of this medium escalate the cost of production. In view of the growing demand of rhizobial inoculants, it is imperative to search for cheap and readily available alternatives to these costly ingredients. A good nutrient source requires faster rhizobial multiplication and lower production of gum in liquid medium.

In the present study, 1% aqueous solutions of commercial quality molasses, malt-extract, jaggery, peptone and yeast-extract were used as the sole source of nutrients. YEM broth[1] was used as a standard medium for comparison. These media were sterilized at 10 p.s.i. for 30 min in an autoclave. On cooling, they were inoculated with freshly grown broth cultures of *R. trifolii* (RC1–4), a fast grower and *R. japonicum* (SB–16), a slow grower and incubated on a rotary shaker (120 rpm) for 48 h in case of the former and 72 h of the latter at 32 ± 2°C. The rhizobial number in each broth culture was enumerated by dilution and plate method using yeast-extract-mannitol-agar medium containing congored[1]. The results are summarized in table 1.

Among different media used, jaggery solution supported maximum growth of slow as well as fast growing strains of *Rhizobium* though it was not comparable to standard YEM broth in this regard (table 1). This suggests that jaggery has intrinsic nutritional value more than other substances tested for the growth of slow and fast growing strains of *Rhizobium*. As Indian[2] and Australian[3] standards

Table 1 *Counts of Rhizobium trifolii and Rhizobium japonicum in six different media*

Organism	Log number of viable rhizobia/ml of broth					
	YEM	Molasses	Malt-extract	Peptone	Jaggery	Yeast extract
R. trifolii (RC1–4)	10.31	9.65	8.65	8.83	10.17	9.16
R. japonicum (SB–16)	10.13	9.22	8.69	7.87	9.93	8.97

S.Em. = 0.05; C.D. at 5% = 0.15.

prescribe mixing of broth cultures containing more than 100×10^6 ml^{-1} rhizobia in carrier, counts obtained in jaggery solution were quite high for preparation of carrier-based inoculants. Jaggery is cheap and easily available locally in India. Its use as an alternate of YEM broth in commercial preparation of inoculants will considerably reduce the cost of production.

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APPLE POMACE — A GOOD SUBSTRATE FOR THE CULTIVATION OF EDIBLE MUSHROOMS

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HIMACHAL Pradesh produces 0.2 to 0.3 million tonne of apple every year. Apple damaged by hail storm and of inferior quality (small-sized) is mainly used for the extraction of juice by the Himachal Pradesh Horticultural Produce Marketing and Processing Plant at Parwanoo and Jarol. After juice extraction the pulp is partly used for cattle feed, whereas large quantities are thrown away. It sometimes causes pollution due to the release of offensive smell especially in humid weather. During December, 1986 profuse growth of *Pleurotus* fruit bodies was observed on rotting pomace at Parwanoo in nature. The specimens were collected for laboratory study. On microscopic examination these were identified as *Pleurotus membranaceus* Massee and *P. euosmus* (Berk. apud Hussey) Sacc. Both the species are reported to be edible. Only the salient features of *P. euosmus* are given but *P. membranaceus* is fully described.

P. membranaceus Massee

Pileus white, thin, fleshy, 4–12 cm in diameter. Epicutis made up of thin- and thick-walled parallel repent hyphae which are 6–9 μm broad. Stipe lateral, short, 0.5–1.5 × 0.6–1 cm, trama consisting of thin- and thick-walled hyaline, 3–7 μm broad hyphae. Lamellae decurrent, thin, densely crowded, slightly interconnected towards the stipe, unequal with 4–5 sets of lamellulae. Hymenophoral trama irregular, made up of thin- and thick-walled hyaline, 4–8 μm broad hyphae, edge fertile. Subhymenium cellular, 8–11 μm in breadth. Basidia tetrasporic, clavate, 25–30 × 5–6 μm, sterigmata conspicuous, 2 μm long. Basidiospores hyaline, cylindrical, smooth, 7.5–9 × 3–4 μm, Cheilocystidia ventricose, 22–30 × 3.5–5 μm. Hyphal system monomitic with thin- and thick-walled non inflating generative hyphae, clamp connections prominent.

It was originally recorded from Pune in 1901 by Massee[1], while Watling and Gregory[2], and Sohi (Aon[3]) collected it from Jammu, on dried stems of *Euphorbia royleana*.

P. euosmus (Berk. apud Hussey) Sacc.

Pileus spathulate becoming flabelliform, 1.5–3 cm, pinkish. Pileal trama consisting of thin- and thick-walled, hyaline 5–9 μm broad hyphae. Stipe lateral, short, 0.4–1 × 0.3–0.5 cm, concolorous with pileus. Lamellae decurrent, light pink, thin, unequal with 4 sets of lamellulae. Basidia tetrasporic, clavate, hyaline, 19–25 × 3.5–5.5 μm. Basidiospores hyaline, cylindrical, smooth, Cheilocystidia clavate, hyaline, 21–35 × 5–8 μm. Hyphal system monomitic with thin- and thick-walled generative hyphae, clamp connections in all hyphae.

It was recorded in 1856 by Berkeley[4] from Sikkim while Singh and Rajarathnam[5] reported it from Mysore in 1977. The present record on apple pomace shows its natural occurrence in Himachal Pradesh also.

The artificial cultivation of different *Pleurotus* species was tried on six-month-old dried apple pomace, steeped in carbendazim (50 ppm) and formalin solution (200 ppm) for 18 h followed by autoclaving in polypropylene bags at 1.4 kg/cm^2 for half an hour. Individual bags were spawned with grain spawn of *P. sapidus*, *P. sajorcaju*, *P. membranaceus*, *P. ostreatus*, *P. flabellatus*, *P. fossulatus* and *Auricularia mesentrica*. These were then incubated at 25 ± 2°C for mycelial spread. Complete spawn run was obtained in 20 days in *P. sajor-caju*, *P. sapidus* *P. membranaceus*, *P. ostreatus* and *P. flabellatus*, while it took 30 days in case of *P. fossulatus* and *Auricularia mesentrica*. Afterwards bags were exposed from the top for fruiting. A relative humidity of 65–70% along with a temperature of 24–27°C was maintained in the