seedlings were collected and brought to the laboratory for further observations. The symptoms of the disease were mainly confined to the hypocotyl zone. The anatomical observations made on microtome sections revealed the fungus in the cortex and conductive tissue (figure 1a–d).

The infected part of the seedling above ground showed wilting symptoms. The seedling ultimately collapsed because of the damage caused by the fungus. The causal organism was isolated and was identified as *Fusarium moniliforme*.

Fusarium spp. is known to cause wilt disease in some tree species[2-5]. However, no seedling disease had been reported in *D. grandiflora*. The disease reported here causes great damage to seedlings in the field, resulting in higher seedling mortality.

For pathogenicity test, forest soil was collected and sterilized at 15 p.s.i. for 1 h thrice intermittently on three consecutive days. The sterilized soil was placed in sterilized pots (size 8 in × 8 in) and left for two weeks to minimize toxic effects. It was then amended with *F. moniliforme* cultured on Czapeck agar medium for one week (inoculum 300 spores/ml). Seedlings of *Duabanga* were raised separately in a BOD incubator at 30 ± 1°C under continuous illumination (1300–1500 lux). Seedlings with 2–3 cm radicles were planted in the fungus-infested soil in the pots. One set of seedlings was kept as control in soil without the test fungus. The pots were kept at room temperature (26 ± 2°C) and watered with sterilized water on alternate days. The seedlings showed the first sign of wilting on the 25th day after transplantation. The roots and the hypocotyl regions were found to be damaged, and the damage caused the death of the seedlings. Re-isolation of the fungus from the diseased seedlings yielded a culture of *F. moniliforme* identical with the original one.

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ROLE OF PHENOLS IN RESISTANCE TO TOMATO LEAF CURL VIRUS, FUSARIUM WILT AND FRUIT BORER IN *LYCOPERSICON*

M. K. BANERJEE and KALLOO
Department of Vegetable Crops, Haryana Agricultural University, Hisar 125 004, India

TOMATO (*Lycopersicon esculentum* Mill.) is an important vegetable crop grown throughout the world. However, tomato plants are susceptible to various diseases and pests. Among these, tomato leaf curl virus (TLCV), fusarium wilt (*Fusarium oxysporum* f. *lycopersici*) and the fruit borer (*Heliothis armigera* Hübner) are very serious in most parts of the country. Preformed phenols play a protective role in resistance to certain diseases and pests.

Four cultivated varieties, viz. HS 101, Pusa Ruby, Red Cherry and Manzana, and two accessions of *L. hirsutum* f. *glabratum*, B 6013 and WIR 4172, were taken for the studies. Seedlings were grown in clay pots containing a mixture of soil, sand and FYM in the ratio 1:1:1. The potted plants were fertilized and watered with Hoaglands solution, and grown in insect-proof cages. A random method of composite sampling was adopted, comprising top, middle and lower leaves of 105-day-old plants. Total phenol content was determined following the method of Swain and Hillis[1] using Folin Dennis reagent and is given as micrograms per gram of fresh leaves. Five samples were used in each case and the data were analysed statistically using CRD design.

Table 1 shows the results of screening the four varieties of *L. esculentum* and the two accessions of *L. hirsutum* f. *glabratum* against TLCV, fusarium wilt and fruit borer.

L. hirsutum f. *glabratum* is also resistant to pinworm, horn-worm, spider mite, leaf miner, root rot and TMV, and cold and frost[5]. *L. hirsutum* f. *glabratum* B 6013, a resistant wild species, has high (134.22 μg per g) total phenol compared to the susceptible commercial varieties (24.42 μg/g in Red Cherry to 31.46 μg/g in Pusa Ruby) (table 1). The differences in total phenol content are highly significant. Tomato varieties resistant to early blight[6] (*Alternaria solani*), bacterial wilt[7] (*Pseudomonas solanacearum*) and root knot nematodes (*Meloidogyne* spp[8]) were also shown to have higher phenol content than susceptible varieties. Phenolic substances and their oxidation products, quinones, have been reported to play an important role in resistance of

Table 1 *Reaction of some Lycopersicon genotypes of tomato leaf curl virus (TLCV), fusarium wilt and fruit borer, and total phenol content in leaves*

Genotype	Resistance/susceptibility			
	TLCV	Fusarium wilt	Fruit borer	Total phenol (μg/g fresh weight)
Resistant wild species				
L. hirsutum f. *glabratum* B 6013	HR	HR	HR	134.22
L. hirsutum f. *glabratum* WIR 4172	–	I	–	124.37
Susceptible cultivated varieties				
L. esculentum cv. HS. 101	S	MS	S	30.10
L. esculentum cv. Pusa Ruby	S	S	HS	31.46
L. esculentum cv. Red Cherry	HS	–	S	24.42
L. esculentum cv. Manzana	HS	–	S	30.24
C.D. at 5%				2.62
C.D. at 1%				3.55

I, Immune; HR, highly resistant; R, resistant; MS, moderately susceptible; S, susceptible; HS, highly susceptible.

many plants to pathogens[9]. The most commonly cited example of resistance due to phenolic substances is that to onion smudge caused by *Colletotrichum circinans*. Protocatechuic acid and catechol, present in the dried scales of coloured varieties of onion as free phenols, inhibit spore germination[10]. The root tissue of resistant varieties of potato contains more chlorogenic acid, which acts as a competitive inhibitor of IAA oxidase and has been considered the main mechanism of defence against the wilt pathogen *Verticillium*[11]. Antibiosis is the factor of resistance to fruit borer (*Heliothis armigera*) in *L. hirsutum* f. *glabratum*[4]. The exact mode of action of phenolic compounds in reducing the incidence of TLCV is not yet known. However, high phenol content inactivates the virus[12]. On the basis of high phenol content in plants, disease and pest resistant lines can be identified in tomato even in the *esculentum* types, and these can be more conveniently used for breeding. *L. hirsutum* f. *glabratum* B 6013 is a good donor and it is easily crossable with *L. esculentum* as male parent. This wild species can therefore be used in a breeding programme to develop resistant varieties.

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DETACHED SPIKE TECHNIQUE FOR *IN VIVO* PRODUCTION OF *NEOVOSSIA INDICA* SPORIDIA

S. S. BAINS and H. S. DHALIWAL
Punjab Agricultural University, Regional Research Station, Gurdaspur 143 521, India.

Neovossia indica (Mitra) Mundkur, cause of Karnal bunt of wheat, produces allantoid and