Reports

Early Neolithic Horsebean from Yiftah'el, Israel

Abstract. *Charred seeds of horsebean (*Vicia faba *L.) from the seventh millennium B.C. that were found at Yiftah'el, Israel, push back the known use of this vetch by about 2000 years. Horsebean should be included in the ensemble of legumes grown by some early Neolithic people. The site, situated near the southwest outlet of Biq'at Bet Netofa, lies in a valley with heavy soil suitable for growing contemporary cultivars of horsebean. The still unknown wild ancestor of the horsebean may have originated in similar habitats in the Levant.*

A heap of some 2600 seeds of horsebean (*Vicia faba* L.) from late Prepottery Neolithic B (6500 to 6000 B.C.) was found in 1983 at Yiftah'el in excavations undertaken by the Israel Department of Antiquities and Museums (Fig. 1). The dwelling in which the seeds were discovered was dated from architectural remains and the lithic assemblage (*1*). The site, 140 m above sea level, is located in the southern part of Lower Galilee, 9 km northwest of Nazareth, Israel. The mound of beans, containing a few small lentils [*Lens culinaris* Medik. subsp. *microsperma* (Baumg.) Barul.] but no other extraneous seeds, was on the bottom of a silo in the corner of a room in area C of the excavation. About 7.4 kg of small lentils (*1*), contaminated with a few globular mericarps of cleavers (*Galium tricornutum* Dandy or *G. aparine* L.), were also found on the floor of this room. About 150 more horsebean seeds were found in an adjacent dwelling in 1984.

The charred seeds (mean, 5.5 by 4.7 by 4.0 mm) (Table 1) are well-preserved and, despite being charred, are not severely distorted. The seedcoat is missing, however, and often the radicle, enabling the two cotyledons to come apart easily. Insect damage was not observed. The seeds of *V. faba* were identified by their characteristic morphology. They are flat and wedge-shaped (average thickness to length ratio, 0.74) with the hilum situated at the base of the seed across its entire breadth. The lower third of the cotyledon (34 percent of its length on average) near the hilum is the thickest part, and its lower edge has the characteristic long depression under the hilum. Because of their small size, the beans belong to var. *minuta* (Alef.) Mansf. = var. *minor* (Harz.) Beck (*2, 3*).

The horsebean is known today only as a cultivated plant and is grown in subtropical and temperate regions of both the Old and New World in heavy soil. The origin of the species is still obscure. Pliny (*4*) claimed that horsebean grew wild all over Mauretania. Early in this century Trabut (*5*) reported that he found a novel wild type in the highlands of Algeria, a plant characterized by its small organs and dehiscent pod: *V. pliniana* (Trabut) Murat. Most investigators, however, suspect that *V. pliniana* is an escaped cultivated plant type that has no special habitat nor any wild characteristics that are not found in other varieties of *V. faba* (*6, 7*). De Candolle (*8*) suggested that in the wild the progenitor of the horsebean was found in two locations: south of the Caspian Sea in Asia and in North Africa.

Table 1. Measurements and indices for *Vicia faba*.

Measure	Range	Mean
Length (mm)	4.2, 6.6	5.50 ± 0.42
Breadth (mm)	3.7, 5.7	4.73 ± 0.36
Thickness (mm)	3.2, 4.8	4.04 ± 0.34
Length to breadth (%)	100, 132	116 ± 6
Thickness to breadth (%)	66, 112	86 ± 7

Section *Faba* of the genus *Vicia* contains, besides horsebean and the unconfirmed *V. pliniana*, four or five species of wild plants: *V. galilaea* Plitm. and Zohary, *V. hyaeniscyamus* Mout., *V. johannis* Tamamsch., *V. narbonensis* L., and *V. serratifolia* Jacq. (the last taxon being sometimes included in *V. narbonensis*) (*3, 9, 10*). Although *V. narbonensis, V. serratifolia*, and apparently also *V. johannis* are widespread throughout southeast Europe, the Mediterranean basin, and southwest Asia, the rest are rather rare. The first three were described only recently. The first two grow only within narrow habitats and are endemic to small regions of the Levant. The chromosome number of the wild species is 14 whereas the horsebean has 12. Attempts to produce hybrids by artificial crosses between the wild species and *V. faba* have failed, but the various wild species can be easily crossed among themselves (*7, 10, 11*).

One presently cultivated horsebean, *V. faba* subsp. *paucijuga* (Alef.) Murat. (some taxonomists include it in var. *minuta* = var. *minor*), is characterized by its comparatively small organs as well as small and globular seeds (*2*). This bean morphology is nearly identical to that of the wild vetch *V. narbonensis* L. Since *V. narbonensis* is also cultivated today, though sporadically (*12*), it is difficult to assign distinctly globular seeds from archeological excavations to *V. faba*. Therefore, the eastern Mediterranean Neolithic beans that cannot be identified unequivocally are often described as being "similar to" (cf.) *V. faba* and sometimes as either *V. faba* or *V. narbonensis*. The small number of beans previously found at various sites does not allow determination of whether the beans were cultivated or a wild admixture of another crop. Hillman (*13*), for example, designates one seed from Tell Abu Hureyra in northern Syria from the Prepottery Neolithic B period as *Vicia* cf. *faba* var. *minor*. Hopf (*14*) found 30, mostly spherical seeds, with mean dimensions of 5.3 mm, in contemporary Jericho; first they

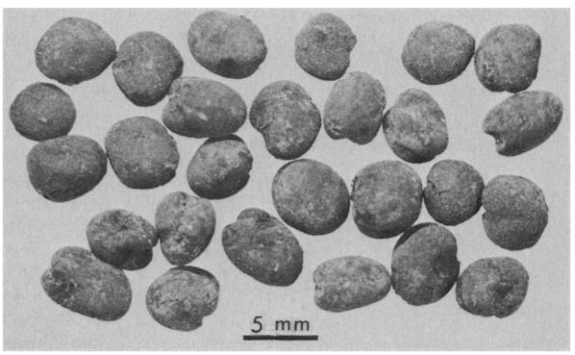

Fig. 1. Charred seeds of horsebean from prepottery Neolithic B period, Yiftah'el, Israel.

were named *Vicia* cf. *faba*, but later *V. narbonensis* or *V.* type *faba*. Van Zeist (*15*) recognized a half seed of *V. faba*/*narbonensis* in the aceramic Neolithic (6000 B.C.) at Cape Andreas-Kastros, Northeast Cyprus. Costantini (*16*) reports two seeds of *Vicia* cf. *faba* from Neolithic (beginning of the fifth millennium B.C.) at Uzzo Cave, northwest Sicily. The earliest, previous positive identifications of horsebeans are reported from a younger Neolithic period (about 4000 B.C.) at sites at Sesklo and Dimini, Greece (*17*). Later Neolithic finds are known from Italy, Spain, Hungary, and Poland; Bronze Age finds are more common (*18*).

Vicia faba is the last important Old World cultivated legume the progenitor of which is still unknown. However, the discovery of cultivated horsebean at Yiftah'el from such an early period may indicate that the ancestor of this plant might have originated in the Levant or its surroundings.

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19. I thank U. Plitmann for valuable suggestions on the manuscript, R. Weiss and S. Shalom for technical assistance, and J. Muravich for the photograph. The material was obtained through the courtesy of the Israel Department of Antiquities and Museums, which also supported this research.

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The Product of the c-*fms* Proto-oncogene: A Glycoprotein with Associated Tyrosine Kinase Activity

Abstract. *The c-*fms *proto-oncogene is a member of a gene family that has been implicated in tumorigenesis. Glycoproteins encoded by c-*fms *were identified in cat spleen cells by means of an immune-complex kinase assay performed with monoclonal antibodies to v-*fms*–coded epitopes. The major form of the normal cellular glycoprotein has an apparent molecular weight of 170,000 and, like the product of the viral oncogene, serves as a substrate for an associated tyrosine-specific protein kinase activity in vitro. The results suggest that the transforming glycoprotein specified by v-*fms *is a truncated form of a c-*fms*–coded growth factor receptor.*

The retroviral oncogene v-*fms* (*1*, *2*) of the McDonough strain of feline sarcoma virus (SM-FeSV) (*3*) encodes an integral transmembrane glycoprotein (*4*–*6*) whose expression at the cell surface is required for transformation (*5*). The biochemical and topological properties of the transforming glycoprotein are similar to those of a group of cell surface receptors for extracellular growth factors (*7*) and particularly to the v-*erb* B oncogene product, which is now known to be a truncated form of the epidermal growth factor (EGF) receptor (*8*). The mature glycoprotein encoded by v-*fms* is oriented in the plasma membrane with its glycosylated amino terminal portion (~450 amino acids) outside the cell and its carboxyl-terminal portion (~400 amino acids) in the cytoplasm (*5*, *6*, *9*). Nucleotide sequencing has predicted that a 200–amino acid segment of the distal cytoplasmic domain is related to a family of oncogene products that function as tyrosine-specific protein kinases (*9*). Indeed, immune complexes prepared with antibodies to the v-*fms* gene product exhibit a tyrosine kinase activity that phosphorylates the glycoproteins in vitro (*5*, *10*). The product of the cellular proto-oncogene (c-*fms*) has now been identified. We show that antibodies directed to the extracellular amino terminal domain of the v-*fms*–coded polypeptide precipitate glycoproteins of 170 and 130 kilodaltons (kD) from normal cat spleen. These polypeptides are active as substrates in an immune-complex kinase assay.

A species of RNA related to v-*fms* and 3.7 to 4.0 kilobases (kb) in length has been detected in different tissues, including mouse and human placental trophoblasts and choriocarcinoma cell lines (*11*), the murine myeloid cell line WEHI-3B (*12*), human bone marrow cells (*13*), and various human tumors (*14*). Because we were unable to detect a c-*fms* gene product in several murine and human cell lines that express c-*fms* RNA, we used a Northern blot method to analyze RNA from adult cat tissues for transcripts that hybridized to a v-*fms* probe. When equal quantities of polyadenylated RNA from cat spleen, brain, bone marrow, and liver were compared, relatively large amounts of 3.7-kb c-*fms* RNA were detected in spleen, intermediate amounts (~10 percent of spleen) were detected in brain, and substantially smaller amounts were detected in bone marrow and liver. Also seen in spleen cells were small amounts of 4.5- and 5.2-kb transcripts that may correspond to species of RNA detected in WEHI-3B cells (*12*).

To screen cat tissues for a putative c-*fms* gene product, we used a sensitive

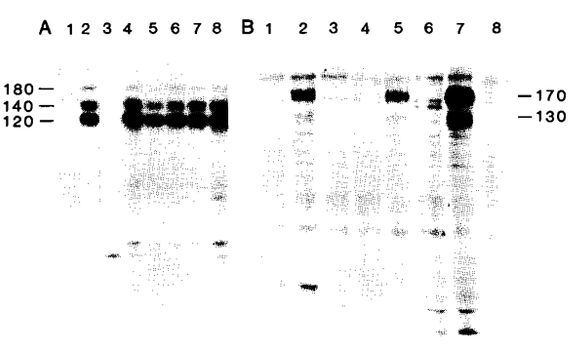

Fig. 1. Endogenous immune-complex kinase assay for products encoded by v-*fms* (A) and c-*fms* (B). Immune complexes were prepared with the antibodies listed below and incubated with [γ-^{32}P]ATP, and the products phosphorylated in vitro were analyzed on gels (*23*). Immune reagents included normal rat serum (lane 1), polyvalent rat antiserum to v-*fms*–coded glycoproteins (lane 2), control myeloma protein (lane 3), and the following rat IgG monoclonal antibodies to v-*fms*–coded epitopes: SM1.32.6 (lane 4), SM2.6.3 (lane 5), SM3.19.4 (lane 6), SM5.15.4 (lane 7), and SM6.2.10 (lane 8). Estimated molecular sizes of the v-*fms*–coded glycoproteins (left) and cat spleen (right) kinase substrates are in kilodaltons. Exposure times for autoradiography were 30 minutes (A) and 8 hours (B).