confirmed in a continuing series of laboratory studies in Mexico (Hernández *et al.*, 1984; Torreblanca & Hernández, 1990). However, X-ray studies carried out by Ramírez (1990) showed that adults and larvae tunnel indiscriminately in all directions within the grain. Indiscriminate damage to germ and endosperm is also described by Subramanyam *et al.* (1987). Probably the results obtained depend to some extent on whether the grain is presented to the insect shelled or on the cob, and on the relative hardness of germ and endosperm in the particular variety tested.

BIOLOGY AND ECOLOGY

Hosts

Initial work on larger grain borer concentrated on its role as a pest of stored products, especially maize and dried cassava roots. Reproduction was also recorded on soft wheat, chickpeas and artificial grains of compacted cereal flour (Howard, 1983, and other authors reviewed by Hodges, 1986). Infestation of sorghum has now been reported from India (Verma & Lal, 1987; Verma *et al.*, 1988) and from Jalisco State in Mexico (Vallejo, 1985), though reproduction on this commodity is not specifically mentioned; moreover, it is possible that these reports result from misidentification of the pest.

Dried roots of cassava (*Manihot esculenta*) have been known for some time to provide a satisfactory substrate for the development of larger grain borer (Nyakunga, 1982). More recently, previously par-boiled, dried tubers of white yam (*Dioscorea rotundata*) and sweet potato (*Ipomoea batatas*) have also been shown in the laboratory to support reproduction of the insect (Jalloh, 1989). Reproduction was also recorded on dried sweet potato by Li (1988). Various roots (as well as grain) imported to the United States from Mexico and Guatemala were found to be infested by larger grain borer (Riley, 1894); this led Chittenden (1911b) to conclude that roots and tubers are the natural host of the pest. However, it is not clear under what field conditions naturally-occurring roots and tubers would become sufficiently dry to provide a satisfactory substrate for development. Li (1988) reported development of larger grain borer on acorns (from English oak, but not on those from 'scarlet' oak) in the laboratory. Given the prevalence of a great diversity of oak species in the area of origin of the insect, it is possible that these represent a natural host for larger grain borer, though this has not so far been proved by field collections.

Although it has been suggested that larger grain borer as a pest of maize probably originated relatively recently from a borer of wood or other plant parts (Chittenden, 1911b), the influence of this factor does not seem to have been generally considered important in assessing the present pest status and incidence of the larger grain borer. More recently the use of pheromone traps has revealed the widespread occurrence of larger grain borer outside the maize production and storage system (Herrera *et al.*, 1989 & 1991; Rees *et al.*, 1990b; Ríos, 1991) and has led to an intense interest in possible alternative or natural host plants.

The woody stems of cassava and flamboyant (*Delonix regia*) have been shown experimentally to support the reproduction of larger grain borer (Detmers *et al.*, 1990), a capacity that the authors attribute to the high starch content of these materials. Two unspecified species of wood were also observed to support larger grain borer reproduction in Benin (Laborius, 1990b, quoting Krall, personal communication). An intensive laboratory investigation of the use of wood by larger grain borer (Detmers, 1988) did not reveal reproduction on any of 15 tropical and 10 temperate woods tested, though this may have been due to the experimental conditions. On the other hand, adults survived for more than 100 days in the wood samples and emerged in response to a change in relative humidity or the presence of maize (Detmers, 1988; Laborius, 1990b).

In the pest's area of origin, considerable efforts have recently been invested in the search for natural infestations and the testing of local plant materials in the laboratory as substrates for reproduction. In Costa Rica, Böye (1988) tested the wood of four local tree species and in the Mexican highlands various trees, succulents, canes and woody shrubs were investigated by Ríos (1991) in an area where larger grain borer was particularly abundant. In the latter case *Schinus molle* and *Prosopis* sp., used in the construction of stores, were extensively bored (as were several other plant materials), but in neither study was reproduction reported. Similarly, in Honduras, traditional storage structures of pine were heavily attacked and the dead wood of *Spondias purpurea* was readily bored in the laboratory but no reproduction observed (Wright and Novillo, unpublished observations). Finally, natural infestations of *Bursera fagaroides* and *Spondias purpurea* by *P. truncatus*, including immature stages, have now been observed in dry deciduous forest in Mexico (Ramírez *et al.*, 1991); it is suggested that in this situation *P. truncatus* occupies a transient niche in the degradation of branches previously severed by a cerambycid.