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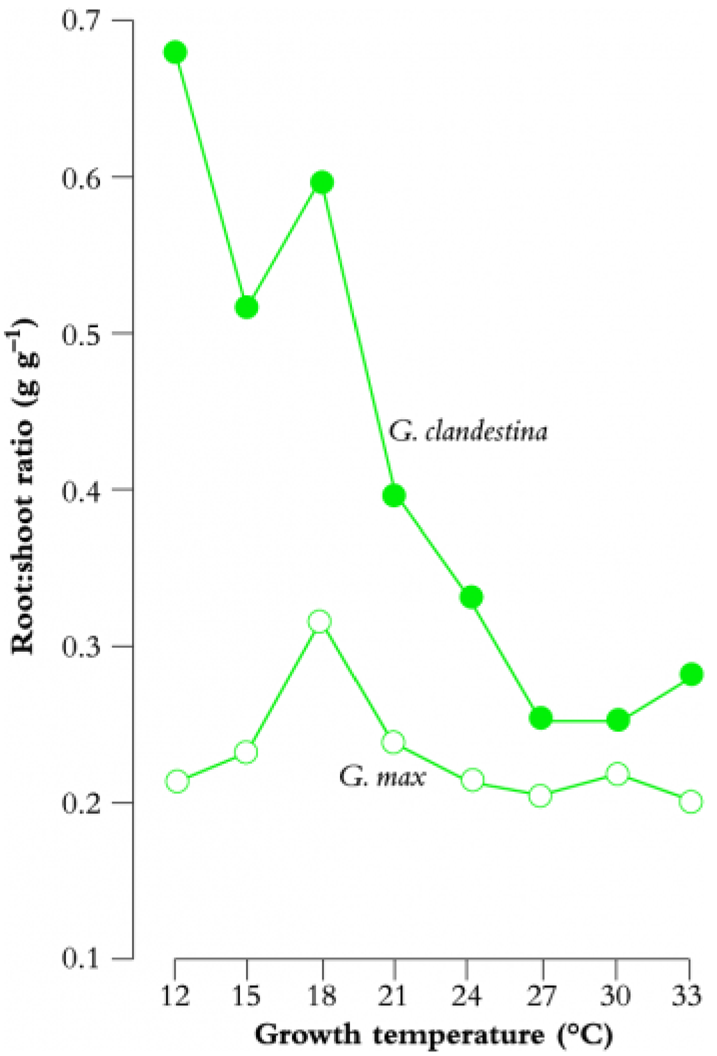
14.2.5?Plant form



[1]

Figure 14.12 The ratio of root mass to shoot mass can change markedly with temperature and this ratio commonly decreases with increasing temperature, illustrated here by an Australian native glycine (*Glycine clandestina*). Cultivated soybean (*G. Max*) on the other hand shows little change in root:shoot ratio with temperature. A high root:shoot ratio at low temperature should not be interpreted to mean that the roots of *G. clandestina*

have low optimum temperature for growth without additional sources of evidence. Moreover, root and shoot temperatures are likely to be significantly different under field conditions. (Based on Kokubun and Wardlaw 1988)

A rise or fall in temperature can result in a marked change in plant form. This may be seen as an alteration in plant height, organ shape or branching patterns in either shoots or roots. The leaf area ratio (leaf area/total plant dry mass) of wheat, for example, increases with temperature from 10°C to 25°C because growth in leaf area is promoted more than stem or root growth, and leaves are thinner. In some cases these changes may result from direct temperature effects on the organs concerned, or may reflect changes in either nutrition or the availability of photosynthate (source/sink balance), or possibly changes in the level and location of growth regulators.

Are there different temperature optima for the growth of different plant organs? In an attempt to explain a commonly observed increase in root:shoot ratio at low temperature, carefully structured studies based on split root experiments showed that the optimum temperature for root growth is similar to that for shoot growth. Similarly, in tomato there is no clear differentiation between fruit and vegetative tissue in temperature preference.

A possible explanation for an increase in root:shoot ratio at low temperature (Figure 14.12) relates to an apparent dominance of shoot growth over root growth for a limited supply of photosynthate. Lowering temperature of a whole plant would effectively alter this dominance by decreasing the demand for photosynthate by the shoot and allowing a greater proportion of photosynthate to be partitioned to roots. In grasses and cereals there is a developmental sequence where root growth of tillers follows that of the shoot and the root:shoot ratio will take time to adjust where a change in temperature alters the tillering pattern. Overall, branching and tillering (breaking apical dominance) appear to be favoured by low temperature. This could simply be a response to a greater availability of photoassimilate at low temperature. It is more likely, however, that growth regulators such as cytokinins (of root origin) and auxins (of shoot origin) are involved.
