

# TECHNICAL NOTES

## Subterranean Vetch Seed Enhances Persistence Under Grazing and Severe Climates<sup>1</sup>

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### Highlight

Subterranean vetch (*Vicia sativa* subsp. *amphicarpa*) grows widely in the central Anatolia region of Turkey. This variety was grown to determine biological characteristics and adaptation for persistence under heavy grazing. Both aerial and subterranean stems were produced and subterranean seed were larger than aerial seed. Delayed germination enables survival of the species where the climatic conditions are severe.

Vetch (*Vicia*) is a genus of legumes which is grown in many countries in the temperate zones all over the world. This genus of annual and perennial herbs has about 150 species and includes both cultivated and wild forms. Most of these climb by tendrils. All vetches grown commercially are cool temperate annuals of European or West Asiatic origin, grown as summer or winter annuals, depending upon climatic conditions (Whyte et al., 1953).

Like other legumes, vetches are important in nitrogen fixation. Many varieties included in this genus are cultivated for seed, green manure, hay,

and grazing. The important species in cultivation are as follows:

narrowleaf vetch	<i>V. angustifolia</i>
oneflower vetch	<i>V. articulata</i>
purple vetch	<i>V. atropurpurea</i>
woollypod vetch	<i>V. dasycarpa</i>
bitter vetch	<i>V. ervilia</i>
horsebean	<i>V. faba</i>
showy vetch	<i>V. grandiflora</i>
Bard vetch	<i>V. monantha</i>
Hungarian vetch	<i>V. pannonica</i>
common vetch	<i>V. sativa</i>
hairy vetch	<i>V. villosa</i>

Subterranean vetch (*Vicia sativa* subsp. *amphicarpa* Coss. and Kralik) has been reported by Bonnier (1911) to produce subterranean seed capsules. This subspecies, synonymous with *Vicia amphicarpa* Dorthe, grows wild in the Mediterranean coastal areas of France, in some coastal provinces of the Alps, in North Africa, Southeast Asia, and occasionally in southern Europe. It grows widely in central Anatolia region of Turkey and particularly in the province of Ankara. However, in some regions it is scarce due to cultivation of the land for crops.

The ability of subterranean vetch to produce both aerial and subterranean seeds increases winterhardiness, drought resistance, and persistence under heavy grazing. Consequently, it is important that it be established in grazing land and included in the rotation of summer fallow wheat in central Anatolia. Seed of this subspecies was collected and plants were grown to determine the biological characteristics and the best technique for adaptation of the species.

### Method of Study

Seed of subterranean vetch was collected from grazing land in the vicinity of Ankara. Plants were grown in

wooden containers with one side of glass. The containers were declined in a manner which made the subterranean growth visible through the glass. This method permitted a study to be made of the development of the root system and the formation of the seed capsules.

### Morphological Characteristics

#### Roots

The radicle appeared on some seeds 3–5 days after moistening for germination and was followed by beaked tip of stem emerging from the embryo cell. The tip was cut off while still curved and new stems grew from the cutting point and from the bottom of the stem where it joined the seed. Many stems grew from this point after germination in soil whether or not the stem was cut. Some of these secondary stems emerged from the soil 10–15 cm away from the main stem and others remained under the soil and produced the subterranean seeds.

The second order roots first developed when the seedling roots were 1–3 cm long. Second order roots emerging from the major root usually appeared 2–3 cm below previous second order roots on the opposite side. Lateral third order roots, 2–3 cm apart from each other, grew out of the second order roots producing a large root system which helps control soil erosion. Two months after germination, the tap root was 35 cm long and second order roots were 8–15 cm long. Nodules clustered around the axis of the tap root. They were dirty yellow in color though roots were white.

#### Stems and Leaves

This vetch produces both aerial and subterranean stems. A full grown plant

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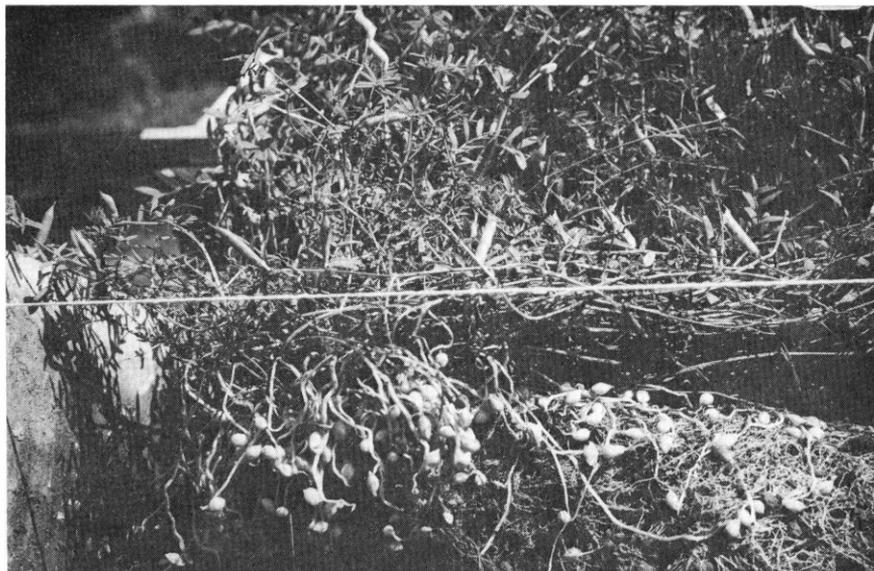


FIG. 1. Aerial seed pods and subterranean seed capsules on vetch plant. Soil level indicated by white line.

was observed to have 80 lateral aerial stems. These varied in height from 20–75 cm. The bright green leaves were 5–8 cm long.

Subterranean stems, 2–10 cm long, usually grew parallel to the surface of the soil. After germination new stems grew from the point where the stem joined the seed and others grew from the concealed bud located near the base of the stems. These stems also grew parallel to the surface. The subterranean stems had no leaves but had a small apophysis. Apophysis was covered with a pellicle. From this apophysis new stems may arise in any direction.

As these new stems grew, those near the surface emerged from the soil and grew much like the aerial stems. They emerged 10–20 cm away from the main stem and almost appeared like separate plants.

#### Inflorescence

The flowers resemble typical flowers of common vetch. When the crop approaches the maturity stage, flower buds begin to appear at the axils where leaves join the stems. Although the formation of the first flower bud changes according to time of seeding, when seeded in autumn it occurs toward the end of March and flowers begin to appear in April. When seeded toward the end of December, flowering occurs in early May.

The *V. amphicarpa* Dorthes grown in France produces only one flower, in

other words, only one flower arises from each axil of leaves. However, the subterranean vetch tested produces 1–2 flowers and gives 1–2 pods. The flowers are colored violet or reddish violet like those of common vetch. A pedicel joins to the stem by means of a nodum and a very short peduncle. A calyx with 5 ridged teeth surrounds the corolla. The length from nodum where peduncle joins the flower to vexiculum is about 1.5–1.6 cm. The aerial seed pod is produced within 4–6 days after fertilization. The flowering stage and production of aerial seed pods and subterranean seed capsules (Fig. 1) occur at the same time.

Inflorescences formed under the soil are white and do not resemble in external appearance those formed above the soil. The subterranean seeds are larger than the aerial seeds. Subterranean seed capsules are white or yellow-white.



FIG. 2. Subterranean vetch pods and seed (left); aerial pods and seed (right).

The seeds are enclosed in a hard husk and are glabrous. The seed pods contain 10–12 seeds and the seed capsules contain 1–2 seeds (Fig. 2). Both pods and capsules normally mature from May 20–30. When planted in December or January they mature toward the end of June.

### Discussion

The germination characteristics of this vetch are important. The percent of aerial seeds germinated was higher than germination of subterranean seeds. Within 3 days after germination, 90.5% of the aerial seeds had germinated. The germination rate of subterranean seeds was 75%. However, seeds which did not germinate were able to germinate after being in contact with moisture for 60–80 days; this wetting is required to crackle the

seed husks. Also, some seed which failed to germinate the first year, germinated when planted again the next year. These characteristics of germination may enable survival of the species in the central Anatolia region of Turkey where the climatic conditions are severe.

The subterranean seeds are never lost and continuously produce annual crop covers. The cutting or grazing of the green portions of the plant will not affect the production of these seeds. Also, it was observed at Tarsus that stems aboveground were not damaged by frost in January 1963–1964, although temperatures dropped below  $-12^{\circ}\text{C}$ . Nor were subterranean stems damaged. Plants often dry up in the Cukurova region of Turkey where it is quite hot by June. However, it is possible to get a large seed crop if seed is planted early and grown in winter.

The vetch should also be tested for use as a cover crop and to improve soil fertility in citrus and fruit orchards. It may also be useful to hold sand dunes and as pasture in gravelly or wooded areas. Much research on other possible uses is needed.

### Literature Cited

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