*Pak. J. Bot.*, 51(2), DOI: 10.30848/PJB2019-2(33)

# STUDY OF WILD PLANT SPECIES OF *BRASSICACEAE* FAMILY IN BAYBURT REGION OF TURKEY

**BETÜL GIDIK[1]*, VOLKAN GÜL[1] AND ABDURRAHMAN SEFALI[2]**

[1]*Bayburt University, Faculty of Applied Science, Department of Organic Farming Managemant, 69000 Bayburt, Turkey*
[2]*Bayburt University, Faculty of Education, Department of Mathematics and Science Education, 69000 Bayburt, Turkey*
**Corresponding author's, email: betulgidik@bayburt.edu.tr*

**Abstract**

The *Brassicaceae* (*Cruciferae*) is one of the most important groups and it has 338 genera and 3709 species around the worldwide. Plant samples of the *Brassicaceae* family were collected and photographed during the vegetation period of 2017. The plant samples and the photos were taken from their natural habitat between 23 April and 11 August 2017. The locations were determined based on differences in geographical features with variable ecological conditions. 38 genera and 80 species and subspecies were identified from different locations of the study area. *Heldreichia bupleurifolia* Boiss. subsp. *rotundifolia, Aethionema caespitosum, Thlaspi lilacinum, Tchihatchewia isatidea, Bornmuellera cappadocica, Aurinia rupestris* subsp. *cyclocarpa, Alyssum stylare, Alyssum pseudomouradicum, Alyssum peltarioides* Boiss. subsp. *peltarioides* are endemic taxa for Bayburt.

**Key words:** *Brassicaceae*, Endemic species of Bayburt, Oil crops, Alternative energy.

## Introduction

The *Brassicaceae* (*Cruciferae*) is one of the most important groups having 338 genera and 3709 species worldwide in distribution (Al-Shehbaz *et al*., 2006).

The *Brassicaceae* family includes many economically important edible and industrial oilseed, condiment, fodder crop species and vegetables. Canola or oilseed rape (*Brassica napus*) is the most important oil crop of the family (Alagoz & Toorchi, 2018). In addition, *Brassica oleracea* is one of the important vegetable crops. Additionally, *Brassicaceae* includes same biodiesel fuel or protein crops as *Camelina sativa*, *Eruca vesicaria*, *Crambe abyssinica*, *Brassica carinata* (Gugel and Falk, 2006; Warwick and Gugel, 2003; Warwick *et al*., 2006, 2007).

Turkey is one of the richest countries in the world in terms of the number of the *Brassicaceae* species (Al-Shehbaz *et al*., 2007). It is also strategically important due to its location. Bayburt is located between 40 degrees 37 minutes north latitude 40 degrees 45 minutes east longitude, 39 degrees 52 minutes south latitude 39 degrees 37 minutes west longitude in the Black Sea Region of Turkey. The city is situated at the Coruh River and has an altitude of 1550 m from the sea with a surface area of 3741 km². Erzurum neighbors the city to the east, Gümüşhane to the west, Trabzon and Rize to the north and Erzincan to the south. Bayburt has a climate showing the characteristics of both the eastern Black Sea climate and the eastern Anatolian climate with terrestrial features. Therefore, in Bayburt, summers are hot and arid, and the winters are cold and rainy (Anon., 2013).

The wild *Brassicaceae* species in natural habitats have provided information about useful genes for future breeding studies on important cultural crops such as *Brassica oleracea, Camelina sativa, Brassica napus* and have helped to find new crops for agricultural production as well as natural conservation. Although a number of researchers have determined wild species in natural habitats and have carried out taxonomic studies, there are still numerous wild species to be identified (Gıdık *et al*., 2016).

*Brassica juncea*, *Armoracia rusticana*, *Sinapis alba* and *Erysimum* ssp. of *Brassicaceae* are used as spices. *Brassica carinata*, *Camelina sativa*, *Crambe abyssinica* and *Eruca vesicaria* have significant potential for edible oil, protein plants, biodiesel fuel plants and molecular agriculture (Gugel & Falk, 2006; Warwick *et al*., 2007). Genus *Alyssum* is represented by 99 species of which 56 are endemic to Turkey. The genus *Aethionema* is represented with about 45 taxa in Turkey, including 20 endemic taxa (Güner *et al*., 2012). Within the family *Brassicaceae, Draba*, with 350 species, is one of the largest genera (Appel & Al-Shehbaz, 2002; Koch & Al-Shehbaz, 2002).

Despite some wild species identified in natural habitats and taxonomic studies by some researchers, there are still some wild species yet to be identified. This study aims to determine the taxa and the endemic species of *Brassicaceae* family in Bayburt.

## Materials and Methods

Plant samples of the *Brassicaceae* family were collected and photographed during the vegetation period of 2017. The plant samples and the photos were taken from the natural habitat between 23 April and 11 August 2017. The locations were determined based on differences in geographical features with variable ecological conditions (Fig. 1). The altitudes of sampling locations varied from 1559 to 2978 m. Plant samples were collected, photographed and recorded at different periods from the beginning to the ending of the vegetation period. During the collection of plant specimens attention was paid to the proper preservation of different organs such as stem and leaf and the reproductive parts of the plant specimens. Plant samples were pressed and dried according to the herbarium technique and stored in the Herbarium of the Bayburt University. Flora of Turkey and the East Aegean Islands (Davis, 1965-1985; Davis *et al*., 1988; Güner *et al*., 2000) were used as the main source for the identification of these samples.

Other Floras such as Flora Iranica (Rechinger, 1965-1977), Flora Europaea (Tutin *et al*., 1964-1981), Flora of Iraq (Towsend & Guest, 1966-1985), Flora Palaestina (Zohary, 1966-1986) and Flora of USSR (Komarov and Shishkin, 1933-1964) have also been utilized in cases when Turkey's Flora was inadequate.

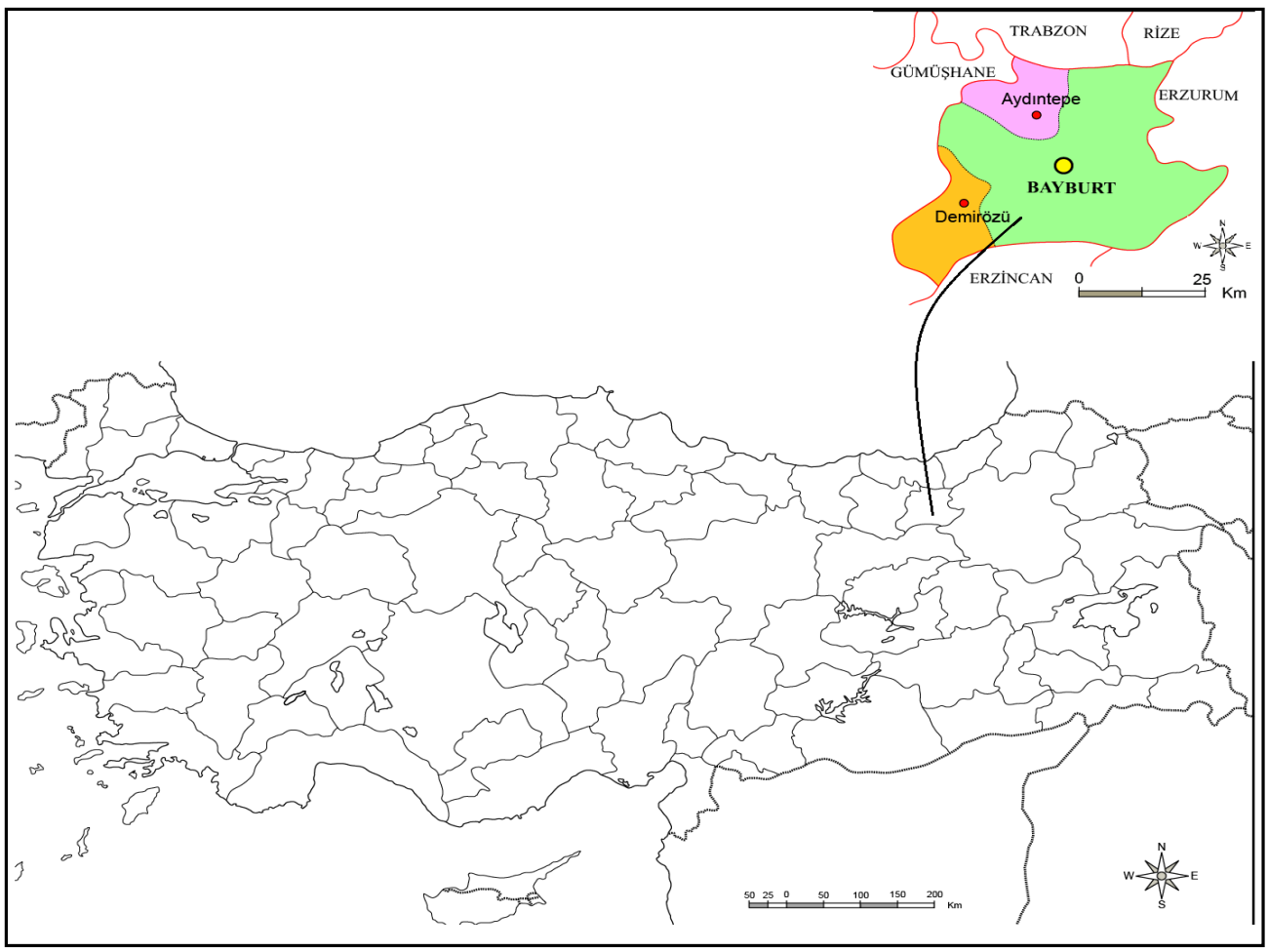


Fig. 1. The map of locations in Bayburt of Turkey.

## Results

In this study, 38 different genera were found. *Aethionema, Alliaria, Alyssum, Arabis, Aurinia, Boreava, Bornmuellera, Brassica, Bunias, Camelina, Capsella, Cardamine, Chorispora, Clypeola, Conringia, Coluteocarpus, Crambe, Descurainia, Draba, Eruca, Erysimum, Euclidium, Fibigia, Heldreichia, Lepidium, Microthlaspi, Murbeckiella, Nasturtium, Neslia, Noccaea, Rapistrum, Sinapis, Sisymbrium, Sobolewskia, Sterigmostemum, Strigosella, Tchihatchewia,* and *Thlaspi* were identified through taxonomic classification of plant samples. Information about the species are shown in Table 1.

While preparing the list, first the family name followed by the generic, species and sub specific name, if any. The author of each taxon was written after confirming from Author of Plant Names (Brummit & Powell, 1992).

In this study, 38 genera were found in different locations of Bayburt. *Aethionema*, *Alyssum*, *Draba* have more than 5 species. Genera and their species are shown in Fig. 2. Different species of *Aethionema* were found between 1645 and 2244 m altitudes. Species of *Alyssum* were found between 1611 and 2129 m and species of *Draba* were found between 1623 and 2098 m altitudes.

*Heldreichia bupleurifolia* Boiss. subsp. *rotundifolia*, *Aethionema caespitosum*, *Thlaspi lilacinum*, *Tchihatchewia isatidea*, *Bornmuellera cappadocica*, *Aurinia rupestris* subsp. *cyclocarpa*, *Alyssum stylare*, *Alyssum pseudomouradicum*, *Alyssum peltarioides* Boiss. subsp. *peltarioides* are endemic for the region of Bayburt. All of the species that determined in Bayburt flora were photographed by Abdurrahman Sefalı. Some endemic species are shown in Fig. 3.

A total of 9 endemic taxa were found between 1674 and 2335 m altitude including a number of different genera.

In this study when determining the hazard categories of endemic taxa at species and subspecies levels "Turkey Plant Red Data Book" (Ekim, 2000) was used (Tables 2 and 3). However, the hazard classes of these taxa have been rearranged according to the 2001 IUCN Categories (Anon., 2013).

Tarkan (1971) conducted researches in Bayburt in the 70s and stated that the region should be included in the Eastern Anatolia Region with its natural and socioeconomic characteristics. The Bayburt region is more similar to the Eastern Anatolia Region in terms of the plant species mentioned in this study rather than the Black Sea Coastal belt.

Considering the distribution of phytogeographic region; 1 Euro-Sib., 4 Euoxine, 15 Iran-Turan, 26 widespread, and the undeclared are shown in table 4.

**Table 1. Plant species identified from *Brassicaceae* family growing in Bayburt and their Turkish names, collecting dates, altitudes, latitudes and longitudes.**

| Genus | Species | Turkish name | Date | Latitude | Longitude | Altitude (m) |
|---|---|---|---|---|---|---|
| *Aethionema* | *Aethionema arabicum* (L.) Andrz. ex DC. | Araptaşçantası | 21.05.2017 | 40$^0$14'40" | 40$^0$09'54" | 1645 |
| | *Aethionema cordatum* (Desf.) Boiss. | Kalpçantası | 26.05.2017 | 40$^0$06'15" | 40$^0$14'35" | 2003 |
| | *Aethionema speciosum* Boiss. & A. Huet subsp. *speciosum* | Somkayagülü | 03.06.2017 | 40$^0$03'27" | 40$^0$09'42" | 2056 |
| | *Aethionema trinervium* (DC.) Boiss. | | 28.05.2017 | 40$^0$06'15" | 40$^0$14'35" | 2003 |
| | *Aethionema iberideum* (Boiss.) Boiss. | Akkayagülü | 20.05.2017 | 40$^0$15'19" | 40$^0$14'40" | 1857 |
| | *Aethionema caespitosum* (Boiss.) Boiss. | Demetkayagülü | 28.06.2017 | 40$^0$13'38" | 40$^0$14'11" | 1773 |
| | *Aethionema membranaceum* (Desv.) DC. | Eteklikayagülü | 05.07.2017 | 40$^0$17'20" | 40$^0$33'26" | 2244 |
| | *Aethionema armenum* Boiss. | Taşçantası | 21.06.2017 | 40$^0$25'31" | 40$^0$28'57" | 1738 |
| *Alliaria* | *Alliaria petiolata* (M. Bieb.) Cavara & Grande | Sarmısak hardalı | 05.05.2017 | 40$^0$15'03" | 40$^0$13'58" | 1559 |
| *Alyssum* | *Alyssum linifolium* Stephan ex. Willd. var *linifolium* | Çıplak kuduzotu | 28.04.2017 | 40$^0$17'27" | 40$^0$08'49" | 1611 |
| | *Alyssum stylare* (Boiss. & Balansa) Boiss. | Dallı kuduzotu | 14.05.2017 | 40$^0$15'36" | 40$^0$13'10" | 1674 |
| | *Alyssum desertorum* Stapf. | Dumanotu | 28.04.2017 | 40$^0$14'24" | 40$^0$04'24" | 1728 |
| | *Alyssum strictum* Willd. | Dik kuduzotu | 28.05.2017 | 40$^0$23'47" | 40$^0$05'35" | 1623 |
| | *Alyssum simplex* Rudolph | | 06.05.2017 | 40$^0$14'01" | 40$^0$04'34" | 1673 |
| | *Alyssum pseudomouradicum* Hausskn. & Bornm. ex Baumg. | Yoluk kuduzotu | 17.06.2017 | 40$^0$02'13" | 40$^0$28'04" | 2129 |
| | *Alyssum pateri* Nyár. | Kanatlıkevke | 21.06.2017 | 40$^0$25'30" | 40$^0$30'00" | 1811 |
| | *Alyssum murale* Waldst. & Kit. | Seki kuduzotu | 14.07.2017 | 40$^0$02'13" | 40$^0$02'04" | 2129 |
| | *Alyssum peltarioides* Boiss. subsp. *Peltarioides* | Köse kuduzotu | 14.07.2017 | 40$^0$02'13" | 40$^0$02'04" | 2129 |
| *Arabis* | *Arabis brachycarpa* Rupr. | Gölkazteresi | 28.06.2017 | 40$^0$31'25" | 40$^0$27'07" | 2978 |
| | *Arabis alpina* L. | Kazteresi | 03.06.2017 | 40$^0$29'05" | 40$^0$33'32" | 2062 |
| | *Arabis nova* Vill. | Tıfilkazteresi | 20.05.2017 | 40$^0$25'54" | 40$^0$28'14" | 1758 |
| *Aurinia* | *Aurinia rupestris* subsp. *cyclocarpa* (Boiss.) Cullen & T.R. Dudley | Kayaincisi | 26.05.2017 | 40$^0$15'19" | 40$^0$14'40" | 1857 |
| *Boreava* | *Boreava orientalis* Jaub. & Spach | Sarıot | 04.07.2017 | 40$^0$14'59" | 40$^0$11'11" | 1675 |
| *Bornmuellera* | *Bornmuellera cappadocica* (Willd.) Cullen & T.R. Dudley | Periseyyahotu | 28.05.2017 | 40$^0$28'47" | 40$^0$01'12" | 2052 |
| *Brassica* | *Brassica elongata* Ehrh. | Uzun şalgam | 10.06.2017 | 40$^0$05'43" | 40$^0$13'44" | 1940 |
| *Bunias* | *Bunias orientalis* L. | Çırşalgamı | 15.07.2017 | 40$^0$15'03" | 40$^0$13'58" | 1559 |
| *Camelina* | *Camelina laxa* C.A. Mey. | Eğriketentere | 22.06.2017 | 40$^0$25'31" | 40$^0$28'18" | 1726 |
| | *Camelina rumelica* Velen. | Ketentere | 25.05.2017 | 40$^0$15'40" | 40$^0$13'43" | 1560 |
| *Capsella* | *Capsella bursa-pastoris* (L.) Medik. | Çobançantası | 18.05.2017 | 40$^0$14'29" | 40$^0$14'28" | 1560 |
| *Cardamine* | *Cardamine lazica* Boiss. & Balansa exBoiss. | Kodimotu | 20.05.2017 | 40$^0$06'15" | 40$^0$14'35" | 2003 |
| | *Cardamine uliginosa* M. Bieb. | | 17.06.2017 | 40$^0$30'59" | 40$^0$07'46" | 2061 |
| | *Cardamine impatiens* L. | Sultankodimotu | 22.06.2017 | 40$^0$29'36" | 40$^0$33'48" | 2046 |
| *Chorispora* | *Chorispora tenella* (Pall.) DC. | Kokar külünk | 23.04.2017 | 40$^0$14'29" | 40$^0$14'28" | 1560 |
| | *Chorispora iberica* (M.Bieb.) DC. | Sarı külünk | 06.05.2017 | 40$^0$15'48" | 40$^0$12'21" | 1616 |
| *Clypeola* | *Clypeola jonthlaspi* L. | Akçeotu | 28.05.2017 | 40$^0$23'47" | 40$^0$05'35" | 1623 |
| *Conringia* | *Conringia orientalis* (L.) Dumort. | Kocatelkari | 01.06.2017 | 40$^0$14'01" | 40$^0$04'34" | 1673 |
| | *Conringia planisiliqua* Fisch. & C.A. Mey. | Telkariotu | 29.07.2017 | 40$^0$14'29" | 40$^0$14'28" | 1560 |
| | *Conringia persica* Boiss. | Acemtelkari | 03.06.2017 | 40$^0$14'01" | 40$^0$04'34" | 1673 |
| | *Conringia clavata* Boiss. | Topuztelkari | 30.05.2017 | 40$^0$14'40" | 40$^0$09'54" | 1645 |
| *Coluteocarpus* | *Coluteocarpus vesicaria* (L.) Holmboe subsp. *vesicaria* | Patarıkotu | 12.05.2017 | 40$^0$17'27" | 40$^0$08'49" | 1611 |

**Table 1. (Cont'd.).**

| Genus | Species | Turkish name | Date | Latitude | Longitude | Altitude (m) |
|---|---|---|---|---|---|---|
| *Crambe* | *Crambe orientalis* L. subsp. *orientalis* var. *orientalis* | Akyumak | 06.08.2017 | 40°14'29" | 40°14'28" | 1560 |
| *Descurainia* | *Descurainia sophia* (L.) Webb ex Prantl | Sadırotu | 05.07.2017 | 40°14'13" | 40°14'33" | 1560 |
| *Draba* | *Draba rigida* Willd. | Diri dolama | 03.06.2017 | 40°06'42" | 40°14'12" | 1828 |
| | *Draba polytricha* Ledeb. | Rize dolaması | 15.05.2017 | 40°28'47" | 40°01'12" | 2052 |
| | *Draba hispida* Willd. | Kıllı dolama | 17.06.2017 | 40°32'24" | 40°08'23" | 1935 |
| | *Draba siliquosa* M. Bieb. | Yıldız dolama | 28.06.2017 | 40°28'47" | 40°01'12" | 2052 |
| | *Draba nuda* (Bélanger) Al-Shehbaz & M. Koch | Cıbıl dolama | 01.05.2017 | 40°25'31" | 40°28'57" | 1738 |
| | *Draba nemorosa* L. | Orman dolaması | 05.05.2017 | 40°23'47" | 40°05'35" | 1623 |
| | *Draba huetii* Boiss. | Çayır dolaması | 03.06.2017 | 40°05'42" | 40°03'38" | 2098 |
| | *Draba verna* L. | Çırçırotu | 14.05.2017 | 40°23'47" | 40°05'35" | 1623 |
| *Eruca* | *Eruca vesicaria* (L.) Cav. | Roka | 06.08.2017 | 40°14'29" | 40°14'28" | 1560 |
| *Erysimum* | *Erysimum cuspidatum* (M.Bieb.) DC. | Kuyruklu zarife | 21.06.2017 | 40°05'20" | 40°14'11" | 1965 |
| | *Erysimum repandum* L. | Çatal zarife | 18.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| *Euclidium* | *Euclidium syriacum* (L.) Aiton | Fındık hardalı | 18.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| *Fibigia* | *Fibigia clypeata* (L.) Medik. | Sikkeotu | 26.05.2017 | 40°06'15" | 40°14'35" | 2003 |
| | *Fibigia macrocarpa* (Boiss.) Boiss. | Kocasikkeotu | 25.06.2017 | 40°29'05" | 40°33'32" | 2062 |
| *Heldreichia* | *Heldreichia bupleurifolia* Boiss. subsp. *rotundifolia* (Boiss.) Parolly, Nordt & Mumm. var. *rotundifolia* | Topaç hardalı | 20.07.2017 | 40°02'36" | 40°28'55" | 2335 |
| *Lepidium* | *Lepidium campestre* (L.) Aiton | Horozcuk | 25.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| | *Lepidium perfoliatum* L. | Gübreotu | 06.05.2017 | 40°15'45" | 40°13'51" | 1605 |
| | *Lepidium latifolium* L. | Nujdar | 15.06.2017 | 40°15'14" | 40°13'13" | 1590 |
| | *Lepidium draba* L. | Diğnik | 18.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| | *Lepidium ruderale* L. | Tuzık | 30.07.2017 | 40°15'36" | 40°13'35" | 1556 |
| *Microthlaspi* | *Microthlaspi perfoliatum* (L.) F.K. Mey. | Giyle | 18.05.2017 | 40°14'01" | 40°04'34" | 1673 |
| *Murbeckiella* | *Murbeckiella huetii* (Boiss.) Rothm. | Ovitkodimi | 17.06.2017 | 40°31'40" | 40°13'54" | 2315 |
| *Nasturtium* | *Nasturtium officinale* R.Br. | Suteresi | 11.08.2017 | 40°16'38" | 39°58'35" | 1622 |
| *Neslia* | *Neslia paniculata* (L.) Desv. | Tophardal | 25.05.2017 | 40°14'01" | 40°04'34" | 1673 |
| *Noccaea* | *Noccaea tatianae* Bordz. | Karsdağarcıkotu | 03.06.2017 | 40°03'27" | 40°09'42" | 2056 |
| *Rapistrum* | *Rapistrum rugosum* (L.) All. | Kedi turpu | 06.08.2017 | 40°14'29" | 40°14'29" | 1560 |
| *Sinapis* | *Sinapis arvensis* L. | Hardal | 06.08.2017 | 40°15'53" | 40°12'30" | 1599 |
| *Sisymbrium* | *Sisymbrium altissimum* L. | Ergelenotu | 11.06.2017 | 40°15'59" | 40°12'41" | 1596 |
| | *Sisymbrium orientale* L. | Tarlabülbülotu | 18.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| | *Sisymbrium irio* L. | Çalgıcıotu | 05.07.2017 | 40°15'40" | 40°13'43" | 1560 |
| | *Sisymbrium loeselii* L. | Bülbülotu | 25.05.2017 | 40°15'40" | 40°13'43" | 1560 |
| *Sobolewskia* | *Sobolewskia clavata* (Boiss.) Fenzl | Akyelotu | 14.05.2017 | 40°12'13" | 40°19'24" | 1701 |
| *Sterigmostemum* | *Sterigmostemum incanum* M. Bieb. | Boz süsün | 21.05.2017 | 40°14'40" | 40°09'54" | 1645 |
| *Strigosella* | *Strigosella africana* (L.) Botsch. | Keçe teresi | 18.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| *Tchihatchewia* | *Tchihatchewia isatidea* Boiss. | Allıgelin | 14.05.2017 | 40°06'32" | 40°25'35" | 1820 |
| *Thlaspi* | *Thlaspi arvense* L. | Ekin dağarcığı | 18.05.2017 | 40°14'29" | 40°14'28" | 1560 |
| | *Thlaspi lilacinum* Boiss. & Huet | Mor dağarcık | 20.05.2017 | 40°06'15" | 40°14'35" | 2003 |
| | *Thlaspi ceratocarpon* Murray | Yetim dağarcık | 19.07.2017 | 40°15'39" | 39°57'42" | 1625 |

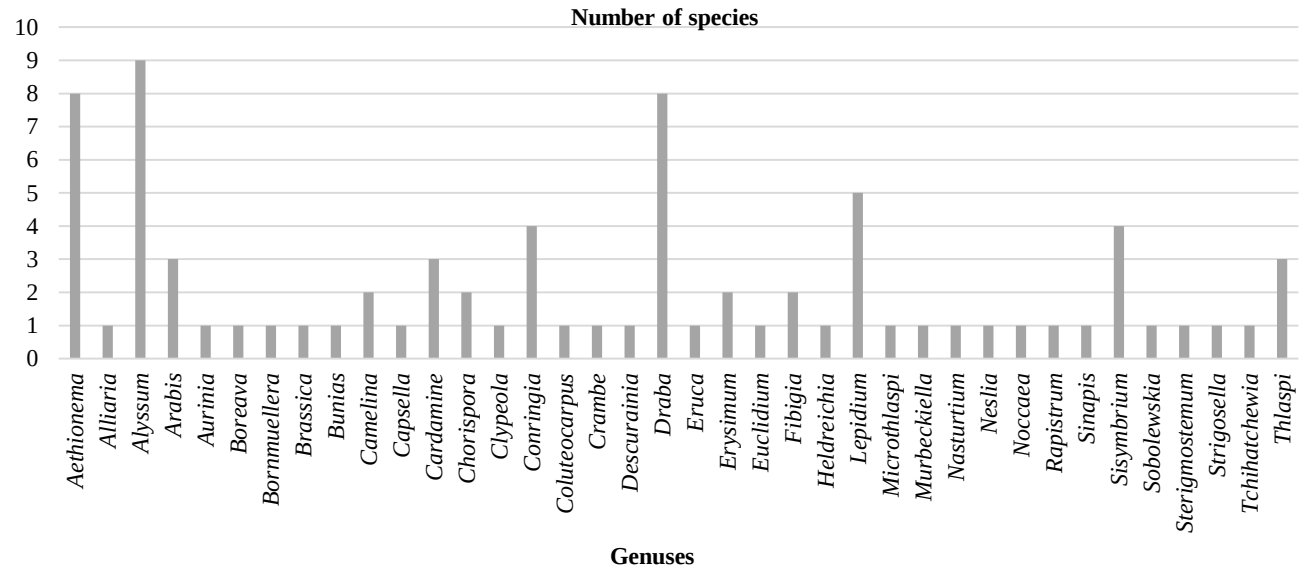


Fig. 2. The number of species beloging to the genuses that found in flora of Bayburt.


Fig. 3. Taxa of *Brassicaceae* that endemic for Bayburt (a). *Heldreichia bupleurifolia* Boiss. subsp. *rotundifolia* (b). *Aethionema caespitosum* (c). *Tchihatchewia isatidea* (d). *Thlaspi lilacinum.*

**Table 2. Endemic taxa of *Brassicaceae* for Bayburt.**

| Species | Altitude (m) |
|---|---|
| *Heldreichia bupleurifolia* Boiss. subsp. *Rotundifolia* | 2335 |
| *Aethionema caespitosum* | 1773 |
| *Thlaspi lilacinum* | 2003 |
| *Tchihatchewia isatidea* | 1820 |
| *Bornmuellera cappadocica*, | 2052 |
| *Aurinia rupestris* subsp. *cyclocar* | 1857 |
| *Alyssum stylare* | 1674 |
| *Alyssum pseudomouradicum* | 2129 |
| *Alyssum peltarioides* Boiss. subsp. *peltarioi* | 2129 |

*Draba* is the largest genus in the *Brassicaceae* with over 370 species (Al-Shehbaz *et al*., 2006). In this study, eight taxa were found belonging to *Draba* genus, including *Draba rigida*, *Draba polytricha*, *Draba hispida*, *Draba siliquosa*, *Draba nuda*, *Draba nemorosa*, *Draba huetii*, *Draba verna*. These taxa were found between 1623 m and 2098 m ASL.

*Camelina* genus is economically important in that it is used for producing bio-fuel. Several authors report that the biofuel, produced from Camelina oil, can cut greenhouse gas emissions (GHG) by up to 75% compared to that of petroleum-based jet fuel (Agusdinata *et al*., 2010; Shonnard *et al*., 2011). *Camelina laxa* and *Camelina rumelica* were found growing between 1560 m and 1726 altitudes in this study.

## Conclusions and Discussion

The results of this research show that the Bayburt region of Turkey possesses number of species of the *Brassicaceae* family belonging to different genera indicating that Bayburt has a suitible climate and eco-geographic conditions for *Brassicaceae*.

Furthermore, species which are important in terms of their economic values such as *Sinapis arvensis*, *Camelina laxa* and *Camelina rumelica* can grow there and some endemic species such as *Heldreichia bupleurifolia* Boiss. subsp. *rotundifolia*, *Aethionema caespitosum*, *Thlaspi lilacinum*, *Tchihatchewia isatidea*, *Bornmuellera cappadocica*, *Aurinia rupestris* subsp. *cyclocarpa*, *Alyssum stylare*, *Alyssum pseudomouradicum*, *Alyssum peltarioides* Boiss. subsp. *peltarioides* are found in Bayburt.

**Table 4. Phytogeographic regions of taxa.**

| Species | PR | Species | PR |
|---|---|---|---|
| *Brassica elongata* Ehrh. | - | *Euclidium syriacum* (L.) Aiton | Widespread |
| *Sinapis arvensis* L. | Widespread | *Neslia paniculata* (L.) Desv. | - |
| *Eruca vesicaria* (L.) Cav. | Widespread | *Bunias orientalis* L. | - |
| *Crambe orientalis* L. subsp. *orientalis* var. *orientalis* | Ir.-Tur. | *Tchihatchewia isatidea* Boiss. | Ir.-Tur. |
| *Rapistrum rugosum* (L.) All. | - | *Fibigia clypeata* (L.) Medik. | - |
| *Conringia orientalis* (L.) Dumort. | - | *Fibigia macrocarpa* (Boiss.) Boiss. | - |
| *Conringia planisiliqua* Fisch. & C.A.Mey. | Ir.-Tur. | *Bornmuellera cappadocica* (Willd.) Cullen & T.R. Dudley | Ir.-Tur. |
| *Conringia persica* Boiss. | - | *Aurinia rupestris* subsp. *cyclocarpa* (Boiss.) Cullen & T.R. Dudley | - |
| *Conringia clavata* Boiss. | - | *Alyssum linifolium* Stephan ex. Willd. var *linifolium* | Widespread |
| *Lepidium campestre* (L.) Aiton | - | *Alyssum stylare* (Boiss. & Balansa) Boiss. | Ir.-Tur. |
| *Lepidium perfoliatum* L. | - | *Alyssum desertorum* Stapf | Widespread |
| *Lepidium latifolium* L. | Widespread | *Alyssum strictum* Willd. | Ir.-Tur. |
| *Lepidium draba* L. | Widespread | *Alyssum simplex* Rudolph | Widespread |
| *Lepidium ruderale* L. | - | *Alyssum pseudomouradicum* Hausskn. & Bornm. ex Baumg. | - |
| *Coluteocarpus vesicaria* (L.) Holmboe subsp. *vesicaria* | Ir.-Tur. | *Alyssum pateri* Nyár. | Widespread |
| *Heldreichia bupleurifolia* Boiss. subsp. *rotundifolia* (Boiss.) Parolly, Nordt & Mumm. var. *rotundifolia* | Ir.-Tur. | *Alyssum murale* Waldst. & Kit. | Widespread |
| *Aethionema arabicum* (L.) Andrz. ex DC. | Widespread | *Alyssum peltarioides* Boiss. subsp. *peltarioides* | Ir.-Tur. |
| *Aethionema cordatum* (Desf.) Boiss. | Ir.-Tur. | *Clypeola jonthlaspi* L. | Widespread |
| *Aethionema speciosum* Boiss. &A.Huetsubsp. *speciosum* | Ir.-Tur. | *Draba rigida* Willd. | - |
| *Aethionema trinervium* (DC.) Boiss. | - | *Draba polytricha* Ledeb. | - |
| *Aethionema iberideum* (Boiss.) Boiss. | Widespread | *Draba hispida* Willd. | Euxine |
| *Aethionema caespitosum* (Boiss.) Boiss. | - | *Draba siliquosa* M.Bieb. | - |
| *Aethionema membranaceum* (Desv.) DC. | - | *Draba nuda* (Bélanger) Al-Shehbaz&M.Koch | Ir.-Tur. |
| *Aethionema armenum* Boiss. | Ir.-Tur. | *Draba nemorosa* L. | Widespread |
| *Microthlaspi perfoliatum* (L.) F.K.Mey. | Widespread | *Draba huetii* Boiss. | - |
| *Thlaspi arvense* L. | - | *Draba verna* L. | Widespread |
| *Thlaspi lilacinum* Boiss. &Huet | Euxine- Ir.-Tur. | *Arabis brachycarpa* Rupr. | Euxine |
| *Thlaspi ceratocarpon* Murray | - | *Arabis alpina* L. | Widespread |
| *Noccaea tatianae* Bordz. | - | *Arabis nova* Vill. | - |
| *Capsella bursa-pastoris* (L.) Medik. | Widespread | *Nasturtium officinale* R.Br. | Widespread |
| *Boreava orientalis* Jaub. &Spach | Widespread | *Cardamine lazica* Boiss. & Balansa ex Boiss. | Euxine |
| *Chorispora tenella* (Pall.) DC. | - | *Erysimum cuspidatum* (M.Bieb.) DC. | Widespread |
| *Chorispora iberica* (M.Bieb.) DC. | - | *Erysimum repandum* L. | Widespread |
| *Strigosella africana* (L.) Botsch. | - | *Alliaria petiolata* (M.Bieb.) Cavara & Grande | - |
| *Sterigmostemum incanum* M.Bieb. | Ir.-Tur. | *Sobolewskia clavata* (Boiss.) Fenzl | Ir.-Tur. |
| *Sisymbrium altissimum* L. | Widespread | *Descurainia sophia* (L.) Webbex Prantl | Widespread |
| *Sisymbrium orientale* L. | - | *Murbeckiella huetii* (Boiss.) Rothm. | - |
| *Sisymbrium irio* L. | - | *Camelina laxa* C.A.Mey. | - |
| *Sisymbrium loeselii* L. | Widespread | *Camelina rumelica* Velen. | - |

PR: Phytogeographic region

Habitats of wild taxa of *Brassicaceae* and the other plant families are damaged by rapid urbanization. In addition, the widespread use of pesticides and other chemical applications has decreased the diversity of these taxa. Therefore, in order to preserve natural flora of Bayburt, the environment and the habitat of different species need to be protected and urban development needs to be planned.

In the Bayburt region, there are several important taxa of the *Brassicaceae* family, of which nine are endemic. Some species in this family have the potential to be used as biofuels and alternative sources of energy. Condiering the ever-increasing need for energy, the value and importance of wild species in this family is increasing. For this reason, it is important to increase the work on wild species found in the *Brassicaceae* family.

**Table 3. The hazard categories of endemic taxa that belong to *Brassicaceae* family**

| Species | The hazard categories |
|---|---|
| *Heldreichia bupleurifolia* (Boiss.) Parolly, Nordt & Mumm. Boiss. subsp. *rotundifolia* var. *rotundifolia* | LR (lc) |
| *Aethionema caespitosum* (Boiss.) Boiss. | LR (nt) |
| *Thlaspi lilacinum* Boiss. & Huet | LR (lc) |
| *Tchihatchewia isatidea* Boiss. | VU |
| *Bornmuellera cappadocica* (Willd.) Cullen & T.R.Dudley | LR (lc) |
| *Aurinia rupestris* (Sweet) Cullen & T.R. Dudley subsp. *cyclocarpa* (Boiss.) Cullen & T.R.Dudley | LR (nt) |
| *Alyssum stylare* (Boiss. & Balansa) Boiss. | LR (lc) |
| *Alyssum peltarioides* Boiss. subsp. *peltarioides* | LR (lc) |

**LR: Lower risk, VU: Vulnerable, lc: Least Concern, nt: Near Threatened**

**References**


Agusdinata, D.B., F., Zhao, K. Ileleji and D. De Laurentis. 2010. Life Cycle Assessment of Potential Biojet Fuel Pro- duction in the United States. *Environ. Sci. & Technol.,* 45: 9133-9143.

Alagoz, M.S. and T. Mahmoud. 2018. An investigation of some key morpho-physiological attributes and leaf proteome profile in canola (*Brassica napus* L.) under salinity stress. *Pak. J. Bot.,* 50(3): 847-852.

Al-shehbaz, İ.H., B. Mutlu and A.A. Dönmez. 2007. The *Brassicaceae* (*Cruciferae*) of Turkey, Updated. *Turk. J. Bot.,* 31: 327-336.

Al-shehbaz, İ.H., M.A. Beilstein and E.A. Kellogg. 2006. Systematics and phylogeny of the *Brassicaceae* (*Cruciferae*): an overview. *Pl. Syst. Evol*., 259: 89-120.

Anonymous. 2013. IUCN. Red List Categories: Version 3.1. Prepared by the IUCN Species Survival Commission. Gland, *Switzerland and Cambridge.*

Anonymous. 2013. Türkiye İstatistik Kurumu, "Seçilmiş Göstergelerle Bayburt 2013". http://www.tuik.gov.tr/ilGostergeleri/iller/BAYBURT.pdf.

Appel, O. and I.A. Al-Shehbaz. 2002. Cruciferae. In: *The families and genera of vascular plants*. (Eds.): K. Kubitzki and C. Bayer, Vol. V. Berlin: *Springer*, 75-174.

Brummit, R.K. and C.E. Powell. 1992. Authors of Plant Names. *Royal Botanic Gardens*, Kew. 732.

Davis, P.H. (Ed.) 1965-1985. Flora of Turkey and the East Aegean Islands. Vol.1-9, Edinburgh: *Edinburgh Univ. Press.*

Davis, P.H., R.R. Mill and K. Tan. (Eds.) 1988. Flora of Turkey and the East Aegean Islands. Vol.10, *Edinburgh: Edinburgh Univ. Press*.

Ekim T., M. Koyuncu, M. Vural, H. Duman, Z. Aytaç and N. Adıgüzel. 2000. "*Türkiye Bitkileri Kırmızı Kitabı*", Türkiye Tabiatını Koruma Derneği ve Yüzüncü Yıl Üniv., Ankara.

Gıdık, B., F. Önemli and E. Cabi. 2016. Determination of wild plant species of *Brassicaceae* family in Turkish Thrace. *Biol. Divers. & Conser.*, 9(3): 100-105.

Gugel, R.K. and K.C. Falk. 2006. Agronomic and seed quality evaluation of Camelina sativa in western Canada. *Can. J. Plant Sci.*, 86(4): 1047-1058.

Güner, A., N. Özhatay, T. Ekim and K.H.C. Başer. (Eds.) 2000. Flora of Turkey and the East Aegean Islands. Vol.10 (supplement 2): Edinburgh: *Edinburgh University Press*. pp. 29-41.

Güner, A., S. Aslan, T. Ekim, M. Vural and M.T. Babac. 2012. Türkiye bitkileri listesi (damarlıbitkiler). [A Checklist of the Flora of Turkey (Vascular Plants)]. *Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını*, Istanbul.

Koch, M. and I.A. Al-Shehbaz. 2002. Molecular data indicate complex intra- and intercontinental differentiation of American *Draba* (*Brassicaceae*). *Ann. Missouri Bot. Gar.,* 89: 88-109.

Komarov, V.L. and Shishkin (Ed.) 1933-1964. Flora of the USSR. (English translation) Moscow and Leningrad: *Akademiya Nauk SSSR*. vols. 1-30.

Rechinger, K.H. (Ed.) 1965-1977. Flora Iranica*,* Graz. *Akademisch Drucku Verlangsanstalt. Graz-Austria.*

Shonnard, D.R., L. Williams and T.N. Kalnes. 2011. Camelina-Derived Jet Fuel and Diesel: Sustainable Advanced Biofuels. *Environ. Prog. & Sustainable Energy,* 3: 382-392.

Tarkan, T. 1971. Yukarı Kelkit ve Çoruh Havzası (Doğal ve Beşeri Coğrafya Etüdü). *Atatürk Üniversitesi Edebiyat Fakültesi Araştırma Dergisi*, 2: 113-170.

Towsend, C.C. and E. Guest. (Eds.) 1966-1985. Flora of Iraq. *Ministry of Agriculture Republic of Iraq,* Baghdad. Vol. 1-4; 8; 9.

Tutin, T.G., V.H. Heywood, N.A. Burges, D.M. Moore, D.H. Valentine, S.M. Walters and D.B. Webb. (Eds.) 1964-1981. Flora Europaea*. Cambridge Univ. Press,* Cambridge, Vol. 1-5.

Warwick S.I., R.K. Gugel and C. Gómez-Campo. 2007. Genetic variation in the *Eruca vesicaria* (L.) Cav. *Plant Genet. Resour. Charact. Util.,* 5: 142-153.

Warwick, S. and I.R. Gugel. 2003. Genetic variation in the Crambe abyssinica – C. hispanica – C. glabrata complex. *Genet Resour. Crop Evol.,* 50: 291-305.

Warwick, S., I.R. Gugel and T. McDonald. 2006. Genetic variation and agronomic potential of Ethiopian mustard (*Brassica carinata*) in western Canada. *Genet. Resour. Crop Evol.,* 53: 297-312.

Zohary, M. 1966-1986. Flora Palaestina., *Jerusalem Academic Pres*., Israel Vol. 1-4.


(Received for publication 7 February 2018)