

Detection of Bean Yellow Mosaic Virus (BYMV) in Common Bean Crops in Isparta and Burdur Provinces, Turkey

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-----ABSTRACT-----

Common bean (Phaseolus vulgaris L.) is an important legume crop worldwide due to its high nutritional value and role in sustainable agricultural systems. However, viral diseases constitute a major constraint to bean production by causing significant yield and quality losses. Among these viruses, Bean yellow mosaic virus (BYMV), a member of the genus Potyvirus (family Potyviridae), is widely distributed in legume-growing regions. Despite its economic importance, information on the occurrence and distribution of BYMV in certain bean-producing areas of Turkey remains limited. The present study aimed to determine the presence and prevalence of BYMV in common bean fields in Isparta and Burdur provinces, Turkey. Field surveys were conducted during the 2025 growing season (July–September), and a total of 92 leaf samples were collected from bean plants exhibiting virus-like symptoms, including mosaic, chlorosis, deformation, and stunting. Collected samples were analyzed using the Double Antibody Sandwich–Enzyme Linked Immunosorbent Assay (DAS-ELISA) for BYMV detection.

DAS-ELISA results revealed that 2 out of 92 samples (2.17%) were infected with BYMV. Positive samples were detected only in Gelincik and Harmanören villages of Isparta province, with infection rates of 10% and 16.66%, respectively. No BYMV infection was detected in samples collected from Burdur province. The observed field symptoms were consistent with those previously reported for BYMV infections under natural conditions. The low incidence of BYMV detected in this study indicates that the virus is currently present at a limited level in the surveyed regions. Nevertheless, its detection highlights the necessity of continuous monitoring and early diagnostic efforts to prevent potential spread and to support sustainable bean production in the region. This study represents the first report of BYMV occurrence in common bean fields of Isparta province.

KEYWORDS;-Bean, Bean yellowmosaic virus, Detection, DAS-ELISA

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I. INTRODUCTION

Legumes, which belong to the family Leguminosae, occupy a significant place in plant production and have maintained their importance in human nutrition for thousands of years. Edible legumes such as common bean, pea, lentil, cowpea, soybean, chickpea, and faba bean constitute a major protein source for more than two billion people worldwide. The common bean (*Phaseolus vulgaris* L.) can be consumed in various forms, including fresh vegetable, dry grain, and canned products. Fresh beans are rich in minerals and vitamins A, B, and D, while dry beans are an important source of protein [1].

In addition to their importance in human and animal nutrition, leguminous crops contribute to soil fertility by enriching the soil with nitrogen through crop rotation systems. Their deep-rooted structures improve soil physical properties and mobilize nutrients from deeper layers to the upper soil profile, making them available to subsequent crops. Therefore, legumes are indispensable components of sustainable crop rotation systems [2]. Among legume crops cultivated worldwide, common bean ranks first and is widely grown across the globe, particularly in subtropical regions. According to FAO data (2020), China ranks first in global bean production, followed by India and Egypt. In Turkey, fresh bean production reaches 505,203 tons on 389,726 decares, while dry bean production amounts to 270,000 tons on 970,520 decares [3]. Although common bean cultivation is carried out in all regions of the country, dry bean production is concentrated mainly in Niğde, Nevşehir, Kahramanmaraş, Aksaray, Balıkesir, Gümüşhane, Karaman, Erzincan, Samsun, and Kütahya provinces.

Isparta province, where this study was conducted, is located in a transitional zone between the Mediterranean mild climate and the continental climate of Central Anatolia. Due to its climatic and soil

characteristics, the region provides suitable ecological conditions for the cultivation of various vegetable crops. In recent years, common bean cultivation has gained considerable momentum in both open-field and protected production systems. In particular, intensive cultivation of common bean and cranberry bean is carried out in Aksu and Senirkent districts of Isparta.

Diseases are among the most important factors causing yield and quality losses in common bean production. In addition to various biotic and abiotic stresses that negatively affect yield, common bean plants are highly susceptible to diseases and insect pests due to their high protein content. Numerous fungal, bacterial, and viral pathogens limiting bean production have been reported worldwide and in Turkey [4]. Viral diseases affecting bean cultivation in many countries are also present in Türkiye and occasionally result in significant yield losses [5,6,7].

Among the viruses infecting leguminous crops worldwide and in Turkey, Bean common mosaic virus (BCMV), Bean common mosaic necrosis virus (BCMNV), Bean yellow mosaic virus (BYMV), Cucumber mosaic virus (CMV), Clover yellow vein virus (CYVV), Tobacco ringspot virus (TRSV), Tomato ringspot virus (TmRSV), Alfalfa mosaic virus (AMV), Soybean mosaic virus (SMV), and Watermelon mosaic virus 2 (WMV-2) have been reported as widespread [8, 9, 10, 11, 12].

Among these, BYMV is widely distributed wherever leguminous crops are cultivated. BYMV belongs to the genus Potyvirus within the family Potyviridae and possesses flexuous rod-shaped particles measuring approximately 750 nm in length and 12–15 nm in width. According to the decision of the International Committee on Taxonomy of Viruses (ICTV) in 2023, the virus has been renamed *Potyvirus phaseoluteum*. The virus has a linear single-stranded RNA genome and exists in numerous strains. BYMV is transmitted by aphids in a non-persistent manner, with the most important vectors being *Acyrtosiphon pisum*, *Macrosiphum euphorbiae*, *Aphis fabae*, *Aphis gossypii*, *Aulacorthum solani*, *Brevicoryne brassicae*, *Rhopalosiphum maidis*, and *Myzus persicae* [13].

In addition, BYMV can be transmitted mechanically through plant sap and contaminated agricultural tools, and at low rates through seed in certain legumes such as lupin (*Lupinus albus*, *L. luteus*), faba bean (*Vicia faba*), and red clover (*Trifolium pratense*). However, seed transmission does not occur in common bean [14].

Symptoms observed in BYMV-infected plants vary depending on the virus strain, bean cultivar, environmental conditions, and the growth stage at which infection occurs. Typical symptoms include bright yellow mosaic patterns and mottling on leaves, which are more pronounced on older leaves. Leaf thickening, downward curling, and wrinkling may also occur. Early infections result in plant stunting, delayed flowering, and reduced pod set. In severely infected climbing and semi-climbing bean types, necrosis may develop at shoot tips, leading to dieback. Although pods generally do not exhibit visible symptoms, a reduction in seed number per pod may occasionally be observed [14].

In Turkey, studies focusing on BYMV are limited [6, 15]. Accurate diagnosis of the virus is crucial for minimizing yield losses caused by viral diseases, preventing their spread, and establishing effective management strategies.

This study aimed to determine the presence and prevalence of BYMV in Isparta province. To the best of our knowledge, no previous study has investigated the occurrence of BYMV in this region. The lack of prior research and the novelty of this investigation contribute to the originality of the study. For virus detection, the serological method DAS-ELISA (Double Antibody Sandwich–Enzyme Linked Immunosorbent Assay) was employed.

II. MATERIAL AND METHODS

Sampling

The plant material of the study consisted of common bean plants collected from bean-growing areas in Isparta province. In addition, following complaints received from bean producers in Burdur province, samples from Burdur were also included in the study. Field surveys were conducted during July, August, and September of 2025 in districts and villages where bean cultivation is practiced in Isparta and Burdur provinces. A total of 92 bean leaf samples were collected during these surveys.

Collection of Infected Plant Material

During field surveys, samples were collected from bean plants exhibiting symptoms such as mosaic, chlorosis, necrosis, deformation, and stunting. Collected samples were stored at –20 °C until analysis.

DAS-ELISA

ELISA kits used in this study (antisera, positive and negative controls) were obtained from Loewe Biochemica GmbH (Germany). An ELISA reader was used for the evaluation of test results. DAS-ELISA was

applied to plant samples that were suspected to be infected with BYMV based on symptomatological observations during field surveys. The assay was performed according to the manufacturer's instructions.

The DAS-ELISA procedure was carried out as follows:

The wells of ELISA plates were coated with coating buffer by adding 200 µl per well and incubated overnight at +4 °C. After incubation, the plates were emptied and washed three times with washing buffer.

Plant samples were homogenized in general extraction buffer, and 200 µl of each extract was added to the wells in duplicate. The plates were incubated overnight at +4 °C.

Following incubation, all wells were washed three times with washing buffer (PBS-Tween). To prevent cross-contamination, the plates were inverted rapidly and tapped onto 8–10 layers of absorbent paper to dry.

Conjugate buffer and conjugates were prepared by dilution, and 200 µl was added to each well. Plates were incubated overnight at +4 °C.

After incubation, wells were washed again with washing buffer and dried as described above.

Substrate solution (p-nitrophenyl phosphate), freshly prepared in substrate buffer, was added at 200 µl per well and incubated at room temperature. Color development was visually monitored.

Samples showing absorbance values at least twice that of the healthy control were considered positive.

III. RESULT VIEW

During surveys conducted in bean-growing areas of Isparta and Burdur provinces, symptoms such as mosaic, yellowing, vein clearing, necrotic lesions, growth retardation, and reduced plant height were observed on bean plants (Figures 1, 2, 3, and 4).



Figure 1: Vein banding and vein constriction on leaves



Figure 2: Leaf deformation and mosaic symptoms



Figure 3: Vein clearing and deformation



Figure 4: Chlorosis, deformation, and vein banding symptoms on leaves

The symptoms observed in this study were largely consistent with those reported in previous field studies conducted under natural conditions [13, 15, 16].

DAS-ELISA Results

Following the application of DAS-ELISA, yellow coloration developed in wells containing positive samples, indicating the presence of BYMV (Figure 5).

A total of 92 leaf samples (69 from Isparta and 23 from Burdur) were tested by DAS-ELISA. The number of collected samples, BYMV-infected samples, and infection rates are presented in Table 1.

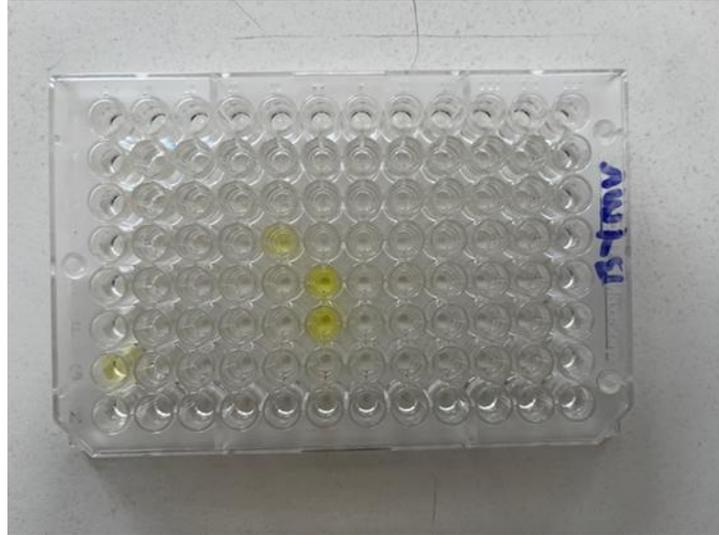


Figure 5: Appearance of positive samples in ELISA plate

Table 1. Occurrence of BYMV in collected samples based on DAS-ELISA results

SamplingLocations	Total Number of fieldsamples	Number of BYMV infectedsamples	Infection rate (%)
ISPARTA			
Gelincik	10	1	10
Aliköy	9	0	0
Yakaören	10	0	0
Harmanören	6	1	16.66
Senirkent	7	0	0
Küçükhacılar	2	0	0
İslamköy	4	0	0
Kuleönü	8	0	0
Büyükgökçeli	6	0	0
Küçükgökçeli	4	0	0
Çünür	3	0	0
BURDUR			
İnsuyu	20	0	0
Çeltikçi	3	0	0
Total	92	2	2.17

According to the DAS-ELISA results, 2 out of 92 samples were found to be infected with BYMV, corresponding to an overall infection rate of 2.17%. Regional infection rates were determined as 10% in Gelincik village and 16.66% in Harmanören village. No BYMV infection was detected in samples collected from other surveyed locations (Table 1).

Positive detections of BYMV were confined to Gelincik and Harmanören villages in Isparta province, while all samples collected from Burdur province tested negative for BYMV. However, previous studies have reported the presence of BYMV in Burdur province (Ulum et al., 2020). The absence of BYMV detection in Burdur during the present study may indicate a decline in the regional virus population over time, reduced vector density, or the influence of cultivar selection and cultivation practices that limit virus transmission. Additionally, the virus may persist at very low levels or may have naturally declined in the region.

Shahraeen et al. [16] conducted surveys in bean-growing areas of East Azerbaijan Province, Iran, and detected BCMV in 155 samples, BCMNV in 105, BYMV in 80, BLRV in 46, SBMV in 35, CMV in 30, and AMV in 10 samples out of 300 tested plants.

Similarly, Dizadji and Shahraeen[17] tested 649 bean leaf samples using DAS-ELISA and reported the presence of BCMV, BCMNV, BYMV, CMV, AMV, BLRV, SBMV, and Bean pod mottle virus (BPMV), with infection rates of BCMV, BCMNV, and BYMV ranging between 17% and 29%.

Studies conducted in Erzincan Province and Western Anatolia reported that BCMV and BYMV are the most widespread and economically significant viral diseases affecting common bean cultivation [18,19].

In Tokat Province, macroscopic examination of bean seed samples revealed symptoms such as wrinkling, shrinkage, cracking, splitting, discoloration, and yellowing. DAS-ELISA tests showed that 59% of seed samples were infected with BCMV, while no BYMV or AMV infection was detected [8]. Ulumetal.[6] reported that 97 out of 443 bean samples (21.89%) collected from Burdur Province were infected with BYMV based on DAS-ELISA results.

Apalak and Baloğlu[15] identified BYMV infection in edible legume samples collected from the Eastern Mediterranean Region. In Silifke district, 2 out of 15 faba bean samples were infected with BYMV, while 2 samples showed mixed infection with SbDV and BYMV. Additionally, among 107 edible legume samples collected from Mersin Province, 2 were infected with BYMV and 2 exhibited mixed infection (SbDV + BYMV). In Hatay Province, BYMV infection was detected in 2 out of 65 samples, with mixed infections observed in an additional 2 samples.

IV. CONCLUSION

The detection of BYMV in only two villages and at a low frequency in Isparta province indicates that the virus is currently present at a low level in the region. Although the virus does not exhibit widespread distribution at present, its persistence suggests that it should not be overlooked. These findings highlight the importance of continued surveillance and periodic monitoring to ensure sustainable disease management and to prevent potential outbreaks in the future.

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REFERENCE

- [1]. Bozoğlu, H. (1995). "Kuru fasulyedebazıtarımsalözellikleringenotip x çevreinteraksiyonuvekalıtımderecelerininbelirlenmesiüzerebiraraştırma", Doktora Tezi. On DokuzMayısMayıs Üniversitesi, Fen Bilimleri Enstitüsü, s.99
- [2]. Pekşen, E., Artık C., (2004). "Antinutritional factors and nutritive values of food grain legumes", 19 May University, Journal of Agriculture Faculty, 20(2), 110-120.
- [3]. TUIK, 2023. Agricultural Crop Production. <http://www.tuik.gov.tr/bitkiselapp/bitkisel.zul>.
- [4]. Güzel, Ö., Arlı-Sökmen, M., (2003). "Determination of some viruses infecting common bean (*Phaseolus vulgaris* L.) and their incidences in seed lots in Samsun Province", Journal of Turkish Phytopathology, 32(2), 99-106.
- [5]. Çulal-Kılıç, H., Yardımcı, N., Açıkıyürek, S., Uzal, A., (2015). "Detection of BCMV, AMV and CMV by DAS-ELISA and Immunocapture-RT-PCR in bean growing areas in The West Mediterranean Region, Turkey", Fresenius Environmental Bulletin, 24(5), 1752-1756.
- [6]. Ulum M., Çulal-Kılıç, H., Yardımcı N., (2020). "Determination of Bean yellow mosaic virus (BYMV) in Common Bean Plants from Burdur Province", Süleyman Demirel University, Journal of Natural and Applied Sciences, 24, 43-47.
- [7]. Usta, M., Güller, A., (2023). "Bean Common Mosaic Potyvirus (BCMNV) characterized from bean (*Phaseolus vulgaris* L.) crops affected by mosaic disease in Denizli Province", Türkiye. Turkish Journal of Agricultural Research, 10(2), 199-207.
- [8]. Kutluk-Yılmaz, N.D., Gümüş, M., Erkan, S. (2002). "Studies on determination of virus diseases in the seeds of bean from Tokat Province", Aegean University, Journal of Agricultural Faculty, 38(3), 49-55.
- [9]. Ghorbani, S.G.M., Shahraeena, N., Elahinia, S.A., (2010). "Distribution and impact of virus associated diseases of common bean (*Phaseolus vulgaris* L.) in Northern Iran", Archives of Phytopathology and Plant Protection, 43(12), 1183-1189.

- [10]. Hosseini, A., Hosseini, S., (2014). "Occurrence and distribution of Bean Common Mosaic Virus and Bean Yellow Mosaic Virus from common bean fields of Kerman Province, Iran", *Indian Journal of Fundamental and Applied Life Sciences*, 4(2), 528-535.
- [11]. Çulal-Kılıç, H., Yardımcı, N., (2015). "Occurrence of Alfalfa Mosaic Virus (AMV) infecting Bean Crop in Burdur Province, Turkey", *Asian Journal of Agriculture and Food Sciences*, 3(2), 173-177.
- [12]. Usta, M., Güller, A., (2020). "Molecular characterization of polyprotein genes of two BCMV (Bean common mosaic potyvirus) isolates in Antalya (Turkey) and their genomic divergence", *Turkish Journal of Agricultural and Natural Sciences*, 7(2), 411-419.
- [13]. Al-Ani, R.A., Adhab, M.A., (2013). "Bean Yellow mosaic virus (BYMV) on Broadbean; Characterization and resistance induced by *Rhizobium Leguminarum*", *Journal of Pure and Applied Microbiology*, 7(1), 135-142.
- [14]. Kızmaz, M.Z., Gümüş, M., (2021). "Detection, biological and molecular characterization of some viruses transmitted by seeds of edible leguminous", *Turkish Journal of Agricultural and Natural Sciences*, 8(3), 784-799, 202.
- [15]. Apalak, A., Baloğlu, S., (2020). "Determination and Characterization of Edible Legumes in the EasternMediterranean Region", *Çukurova University Insitute of Natural and Applied Science*, 39(6), 44-53.
- [16]. Shahræen, N., Ghotbi, T., Dezaji, A., Sahandi, A.,(2005). "A survey of viruses affecting french bean (*Phaseolus vulgaris*) in Iran includes a first report of southern bean mosaic virus and bean pod mottle virus", *Plant Disease*, 80, 1012.
- [17]. Dizadji, A., Shahræen, N.,(2011). "Occurrence, distribution and seasonal changes of viruses infecting common bean in Northwestern Iran", *Archives of Phytopathology and Plant Protection*, 44(17), 1647-1654.
- [18]. Açıköz, S., Çıtır, A., (1986). "Incidence, epidemiology and identification of viruses on *Phaseolus vulgaris* L. in Erzincan Plain in Turkey", *Journal of Turkish Phytopathology*, 15(2), 61-67.
- [19]. Fidan, Ü., Yorgancı, Ü., (1989). "Investigations on the detection and seed transmission of the virus diseases occurring on the pulse crops in Aegean Region", *Journal of Turkish Phytopathology*, 18(3), 93-105.