BÖLÜM

12 BİTKİSEL ETKEN MADDELER

Kanber KARA [1]

GİRİŞ

Bitkisel biyoaktif bileşikler (bitkisel etken maddeler ya da sekonder bileşikler), bitkilerde sentezlenen ve bitki organizmalarının normal büyüme, gelişme veya üreme süreçlerinde doğrudan yer almayan kimyasal bileşiklerdir. Bu bileşiklerin bazıları hastalıklara, herbivor hayvanlara, ultraviyole ve radyasyona, parazitlere ve oksidanlara karşı savunma maddesi olarak görev yaparlar. Üreme süreçlerini kolaylaştırır (çekici kokular ve renklendirici maddeler olarak işlev görürler) ve türler arası rekabete katkı sağlarlar. Bitki kökenli biyoaktif bileşikler, insan ve hayvan sağlığı üzerinde olumlu etkileri olan ikincil metabolitlerdir. Bitkiler; ışık, su, azot, fosfor ve kükürt gibi temel maddeleri kullanarak karbonhidratlar, proteinler ve yağlar gibi birincil ürünleri sentezler. Dünya genelinde yaklaşık 1.000.000 bitki türü bulunduğu, bunlardan 500.000'inin tanımlandığı tahmin edilmektedir. Türkiye, bitki çeşitliliği bakımından dünyanın en zengin ülkelerinden biridir. Ülkemizde yaklaşık 12.000 bitki türü bulunmakta olup bunların yaklaşık 4.000'i sadece Türkiye'de yetişen endemik türlerdir. Sınırları belirli, dar bir alanda (birkaç metrekare ile bir ülke sınırları arasında değişebilir) yayılış gösteren türler, endemik (yerli) bitkiler olarak adlandırılır. Avrupa kıtasının tamamında da yaklaşık 12.000 bitki türü yetişmektedir.

Bitkilerde sentezlenen alkaloidler, fenoller, flavonoidler, glikozitler, saponinler, steroller, tanenler, terpenoidler ve uçucu yağlar gibi maddeler, ikincil bileşikler (sekonder metabolitler) olarak sınıflandırılır. Bitki hücrelerinde bulunup hayvan hücrelerinde yer almayan bir plastid olan kloroplastlar, fotosentez ve birçok sekonder bileşiğin üretiminden sorumludur. Bu plastidler, monoterpen, diterpen, karoten, fitol ve ubikinon gibi bileşiklerin sentezinde rol oynar. Bitkide pigment içeren bir diğer plastid türü olan kromoplastlar da sekonder bileşiklerle ilişkilidir. Bitkilerde 100.000'den fazla sekonder bileşiğin sentezlendiği düşünülmektedir. Sayıca en fazla bulunan bu bileşikler arasında ilk sırada terpenoidler, ikinci sırada ise alkaloidler yer almaktadır. Şekil 1'deki diyagramda bitkisel metabolitlerin karbonhidratlardan başlayarak çeşitli bileşiklere nasıl dönüştüğü görülmektedir.

[1] Prof. Dr., Erciyes Üniversitesi, Veteriner Fakültesi, Hayvan Besleme ve Beslenme Hastalıkları AD., kanberkara@erciyes.edu.tr., ORCID iD:0000-0001-9867-1344

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Tablo 11. Terpenlerin immun sistem üzerine etkileri

Bitki/Hayvan Türü	Terpen Türü	İmmün Sistem Üzerindeki Etkileri	İmmün Yanıt Ürünü	Kaynak
Lavanta (Lavandula angustifolia) - Holstein buzağı	Lavanta uçucu bileşenleri	Hücresel immün yanıtın desteklenmesi	TNF-α, IL-1β, IL-6, SAA	Kara ve Pirci, 2022
İzmir kekiği (Origanum onites L.) - Buzağı	İzmir kekiği uçucu bileşenleri	İmmünglobulin (IgA, IgG, IgM) seviyelerinin artırılması	IgA, IgG, IgM	Özkaya ve ark., 2018
Nane (Mentha piperita L.)	Nane etanol ekstraktı	Antiviral aktivite, sitokin üretiminde azalma	NO, TNF-α, IL-6, PGE2	Li ve ark., 2017
Okaliptüs (Eucalyptus) - Broyler	Okaliptüs yaprağı uçucu bileşenleri	İmmün yanıtın artırılması	IL-6, IL-1β, TNF-α	Farhadi ve ark., 2017
Adhatoda vasica, Curcuma longa, vb. - Buzağı	Bitkisel karışım (ögenol, piperin)	İmmün yanıtın olumlu etkilenmesi	Antikor titresini artırma	Sanchez ve ark., 2021
Sarımsak (Allium sativum) - Holstein buzağı	Sarımsak tozu	IgG seviyelerinin artışı, dışkı skorlarının iyileşmesi	IgG	Kekana ve ark., 2020
Deniz yosunu (KM) - Holstein buzağı	Kuru-öğütülmüş deniz yosunu	Fibrinojen ve SAA seviyelerinin artması	Fibrinojen, SAA	Samarasinghe ve ark., 2021
Ekinezya (Echinacea purpurea) - Holstein buzağı	Ekinezya tozu	Bağışıklık modülasyonu ve inflamasyonun azalması	Lenfosit sayıları, TNF-α, IL-6, IL-10	McNeil ve ark., 2023

artırarak patojenlere karşı daha etkili bir yanıt oluşmasını sağlarlar.

Humoral bağışıklık üzerine etkileri

Vücutta antikor üretimini teşvik ederek humoral bağışıklık yanıtını desteklerler.

Mukozal bağışıklık yanıtı

Uçucu bileşenler, bağırsak mukozasında yer alan immün hücreleri aktive ederek lokal bağışıklık yanıtlarını güçlendirir. İnce bağırsakta IgA üretiminin artışı, patojenlerin mukozal yüzeye tutunmasını engellerler.

Anti-inflamatuar ve immün modülatör etkileri

Enflamasyona neden olan bazı sitokinlerin üretimini azaltırken; bağışıklık sistemini dengeleyen moleküllerin sentezini artırırlar. Bu sayede bağışıklık sisteminin aşırı tepkiler vermesi engellenir, dokular korunur.

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