Subfamily Psychodinae of the State of Kuwait: new faunistic data (Diptera, Psychodidae)

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Abstract. – The non-biting moth flies subfamily Psychodinae (Diptera: Psychodidae) is poorly investigated in Kuwait, compared to the sandflies subfamily Phlebotominae. This study updates the Psychodinae fauna in Kuwait, recording two species sampled from anthropogenic habitats in urban and agricultural areas across six governorates. Background information on *Psychoda alternata* (Say, 1824), previously the only record of the subfamily from the country, is provided. A literature review and a personal communication reveal earlier, undocumented occurrences of a second species, *Clogmia albipunctata* (Williston, 1893), much earlier than presented here. Male and female genitalia of both species were examined, and detailed descriptions of genital and external morphology are provided, accompanied with figures and field photographs. Field observations and habitats are discussed, and a recommendation for a more extensive study of this subfamily in Kuwait.

Résumé. – **La sous-famille des Psychodinae au Koweït : nouvelles données faunistiques (Diptera, Psychodidae)**. La sous-famille des Psychodinae (Diptera : Psychodidae) est peu étudiée au Koweït, par rapport à la sous-famille des Phlebotominae. Cette étude met à jour la faune des Psychodinae au Koweït, en signalant deux espèces échantillonnées dans des habitats anthropiques de zones urbaines et agricoles de six gouvernorats. Des informations de base sur *Psychoda alternata* (Say, 1824), auparavant la seule mention pour la sous-famille dans le pays, sont fournies. Une revue de la littérature et une communication personnelle révèlent des occurrences antérieures et non documentées d'une deuxième espèce, *Clogmia albipunctata* (Williston, 1893), bien antérieures à celles présentées ici. Les organes génitaux mâles et femelles des deux espèces ont été examinés et des descriptions détaillées de la morphologie génitale et externe sont fournies, accompagnées de figures et de photographies de terrain. Les observations de terrain et les habitats sont discutés, et une recommandation pour une étude plus approfondie de cette sous-famille au Koweït est formulée.

ملخص. – تحت عائلة البرغشاوات لدولة الكويت – بيانات حيوانية جديدة (ذوات الجناحين: البرغشية). لم تتم دراسة تحت عائلة البرغشاوات ذباب العث غير القارض (ذوات الجناحين: البرغشية) بشكل جيد في الكويت مقارنة بتحت عائلة ذباب الرمل على الرغم من أن كلاهما يكونان الحيوانات البرغشية للبلاد. تقوم هذه الدراسة بتحديث لائحة البرغشاوات للكويت، وتسجل نوعين تم أخذ عينات منهما من الموائل البشرية المنشأ في المناطق الحضرية والزراعية لست محافظات. تم توفير معلومات أساسية عن النوع (ساي، 1824) *Psychoda alternata*، حيث يعتبر السجل الوحيد للبلاد لتحت العائلة ذاتها في السابق. تكشف المراجعة الأدبية ومشاهدة شخصية واحدة عن حالات سابقة وغير موثقة لنوع آخر، (ويليستون، 1893) *Clogmia albipunctata* في وقت أبكر بكثير مما يتم تقديمه هنا. تم فحص الأعضاء التناسلية الذكرية والأنثوية لكلا النوعين، وتم تقديم وصف تفصيلي من الناحية الظاهرية والأعضاء التناسلية، مصحوباً بالأشكال والصور الميدانية. نوقشت الملاحظات الميدانية والموائل، والتوصية بإجراء دراسة أكثر شمولاً لتحت العائلة في الكويت.

Keywords. – Arabian Peninsula, faunistics, Kuwait, Middle East, moth flies, new records.

Kuwait, including its ten offshore islands, covers an area of 17,818 km² within the Arabian Peninsula's approximate total of 3 million km² (Brook *et al*., 2006; Omar *et al*., 2007) (fig. 1). The country has a semi-arid climate and a topography characterized

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by flat and uneven desert gradually rising from sea level along the eastern coast to a maximum elevation of 300 meters in the west and southwest (KUWAIT GOVERNMENT ONLINE, 2023). According to OMAR *et al*. (2001), about 3.5% of Kuwait's land is urbanized, with agriculture covering 3%, oil industry activities 7%, military uses 4%, other uses 7%, and 75.12% rangeland. Kuwait's arid landscape includes six ecosystems characterized by their soil types and botanical composition, as detailed by HALWAGY & HALWAGY (1974) and OMAR *et al*. (2007) (table I). Rainfall is scarce and occurs primarily from November to April, averaging 116 millimetres over 29 days a year (AL-QALLAF *et al*., 2020). Extreme weather, including flash floods and records above

Fig. 1. – Size of the State of Kuwait relative to the size of the Arabian Peninsula.

Fig. 2. – Map of Kuwait indicating 19 study sites.

Table I. – Six ecological ecosystems of Kuwait and botanical notes (Halwagy & Halwagy, 1974; Omar *et al*., 2007).

Ecological ecosystem	Location and description
Alluvial fan	Found in the western, central and northern sides of the country; characterized by a gypsum hardpan layer locally named "gatch" found below the topsoil, exposed topographically in some areas. The hardpan and gypsum content of the soil typically restrict plant growth, but a few perennials and annuals were observed.
Barchan sand dune	North, northwest and northeast of the country with restricted and scarce plant species.
Coastal plain and lowland	Salt marsh and saline depressions, sand dunes, terraces and ridges, extending north-south of the coastline including all islands. The main botanical composition of this ecosystem is halophytic species.
Desert plain	Aeolian sand deposits west of the coastal plain, southwest and northeast of the country hosting several dominant perennial plant communities.
Escarpments, ridges and hills	Distinguished geomorphologies along the shores, rich in vegetation, with ranges of altitude between 45-135 m.
Wadis and depressions	Wadi Al-Batin and Wadi Umm Ar-Rimam are two known wadis extending down the western border to Iraq and northern region of Kuwait Bay, respectively. The depressions are shallow containing mud playas of silty soil forming drainage systems. Both ecosystems host an array of plant species.

50°C, has increasingly impacted the country in recent years (Al-Qallaf *et al*., 2020; Alahmad *et al*., 2022). Seasonal temperature fluctuations are substantial (table II), with the summer highs ranging from 28-46°C (https://weatherspark.com/y/150245/Average-Weather-in-Kuwait-Year-Round).

The subfamily Psychodinae is one of six subfamilies within Psychodidae, comprising nearly 2000 species, including some well-known species from the genera *Clogmia* Enderlein, 1937, and *Psychoda* Latreille, 1796 (Marshall, 2012). Although species from both genera are generally considered domestic, only certain *Psychoda* species are specifically associated with human habitats (Marshall, 2012). In the Palearctic region, Psychodinae species commonly inhabit springs, streams, soggy soils, vertebrate dung, carrion, wood decay, and leaf litter (Kvifte & Wagner, 2017). The subfamily also holds medical significance due to the potential role of some species in health-related issues (Bejarano & Estrada, 2016).

Studies on the psychodines of the Arabian Peninsula were pioneered by Ježek & van Harten (2002, 2005, 2009). In Kuwait, the psychodine fauna remains understudied, with the trickling filter fly *Psychoda alternata* Say, 1824 (fig. 5-6) first discovered

Table II. – Low and high-temperature ranges per season in Kuwait (Weather Spark, 2024).

Season	Temperature range °C
Spring (Mar, Apr, May)	12-43
Summer (Jun, Jul, Aug)	28-46
Autumn (Sep, Oct, Nov)	11-44
Winter (Dec, Jan, Feb)	8-23

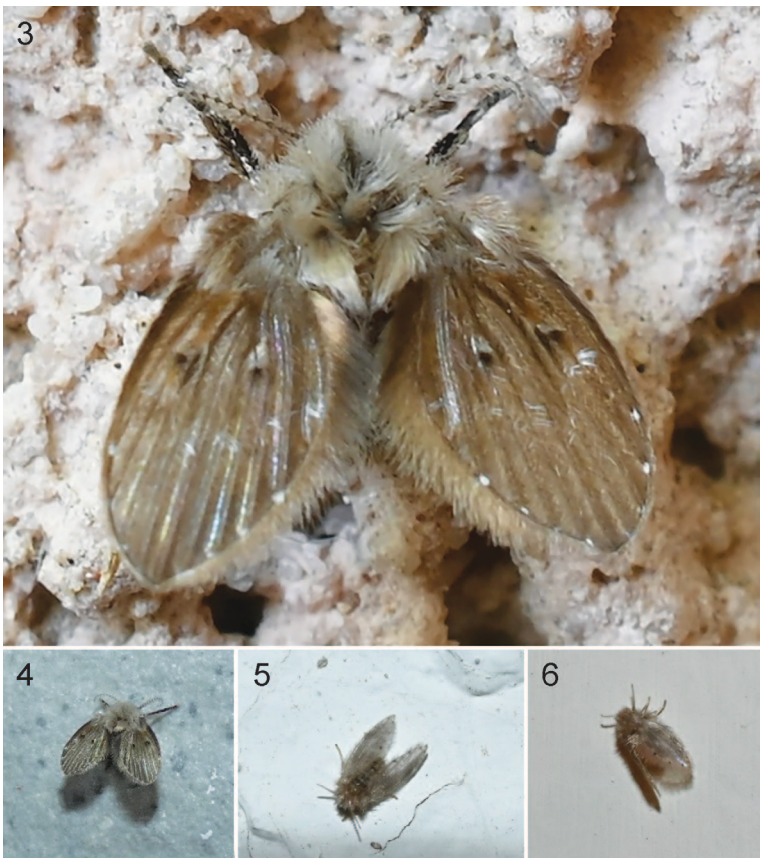

Fig. 3-6. – *Clogmia albipunctata* (Williston) and *Psychoda alternata* (Say) resting on walls (Sites: 2, 10, and 18). – **3-4**, *C. albipunctata*: **3**, on exterior wall of horse stable at FEC (Site 2), 18.III.2023; **4**, on toilet wall of NPCC-AN (Site 10), 27.I.2021. – **5-6**, *P. alternata*: **5**, resting on toilet wall of private farm (Site 18), 22.XII.2023; **6**, on kitchen wall of horse stable at FEC (Site 2), 31.XII.2023.

during surveys conducted by Al-Houty (1989). These surveys, conducted from 1980 to 1988, aimed to address the knowledge gap on Kuwait's insect fauna, leading to an inventory of 648 species across numerous orders and families (Al-Houty, 1997). Further observations from local hospitals in the Farwaniyah and Hawalli governorates (Hira *et al*., 1997) noted larvae of an unidentified *Psychoda* linked to two cases of facultative urinary tract myiasis. The mature fourth-instar larvae from one male patient suggested identification as *Psychoda alternata*.

In 2011, *P. alternata* was documented again in Kuwait's first forensic entomology study by Al-Mesbah (2011), where it was observed among other necrophagous Diptera. In her study, she noted that the species was uncommonly encountered in the country compared to representatives of the families Calliphoridae, Sarcophagidae and Muscidae; she further revealed the association of adult *P. alternata* with decayed rabbit carcasses in a cattle farm in the agricultural area of Sulaibeya (spelled today as Sulaibiya), Jahra Governorate, in 2008. She also observed adult and larvae of the species in 2008 in Sulaibiya and in 2009 in Salmeya (Hawalli Governorate, an urban area in Kuwait City, spelled today as Salmiya) on two human remains. Al-Mesbah documented both adult and larval stages, adding morphological descriptions;

however, an error was noted, with some figures mistakenly representing *Clogmia albipunctata* (Williston, 1893). Additionally, *P. alternata* was mistakenly listed by Amr (2021) and Katbeh-Bader *et al.* (2022) among five species of Phlebotominae recorded in Kuwait —*Phlebotomus alexandri* Sinton, 1928, *P. papatasi* (Scopoli, 1786), *Sergentomyia antennata* (Newstead, 1912), *S. clydei* (Sinton, 1928), and *S. squamipleuris* (Newstead, 1912)— using the synonym *Tinearia alternata*, a misattribution based on earlier records by Hussien & Behbehani (1976) and Lane & Al-Taqi (1983).

Psychoda alternata is a highly adaptable, synanthropic, cosmopolitan species (Ibáñez-Bernal, 2008; Kroča & Ježek, 2019). It originated in North America according to Griffith & Gillett-Kaufman (2018), specifically in Pennsylvania (Say, 1883), but is today encountered all around the world (see Ježek *et al*., 2019). This semi-aquatic species thrives in damp habitats of various nature, including madicolous environments, polluted water, trickling filters, urinals, drains, septic tanks, seaweed beds, decaying organic matter, water-filled tree holes, vegetation, excrements, wadis and karst ecosystems (James, 1947; Satchell, 1947; Gordh & Headrick, 2001; El Bardicy *et al*., 2009; Ježek & van Harten, 2009; Ježek *et al*., 2019; Oboňa *et al*., 2021). *Psychoda alternata* is also considered part of cadaver fauna (Lindgren *et al*. 2015), and has been reported as a pest of potted plants in commercial nurseries triggering possible health issues in neighbouring areas (Pallottini, 2020). In healthcare settings, the larvae are known to induce vomiting (James 1947). Under laboratory conditions, the lifecycle of *P. alternata* spans 21-27 days from egg to adult (El Bardicy *et al*., 2009).

Clogmia albipunctata (fig. 3-4) is an invasive, widely distributed, semi-aquatic species found in both tropical and temperate regions globally, favouring moist habitats such as forests, wadis, water-filled tree holes, and urban environments including sewers, toilets, and kitchens (Duckhouse & Lewis, 1989; Vaillant, 1989; Ježek & van Harten, 2009; Oboňa & Ježek, 2012; Wagner et al. 2013; Jiménez-Guri *et al*., 2014; Kvifte, 2023). In anthropogenic habitats specifically, *Clogmia albipunctata* reproduces within the biofilm of dirty toilet drains, often appearing in high numbers in poorly maintained sewage systems (Boumans *et al*., 2009; Marshall, 2012). The species is also of public health concern as a potential vector of bacterial pathogens linked to nosocomial and nasopharyngeal infections, urinary myiasis and respiratory problems (Mohammed & Smith, 1976; Boumans *et al*., 2009; Faulde & Spiesberger, 2012; El-Badry *et al*., 2014; El-Dib *et al*., 2017; Hjaija *et al*., 2018; Alshimmre & Ismail, 2020;). The lifecycle of *Clogmia albipunctata* from oviposition to the emergence of adult spans approximately three weeks at 25°C (García-Solache *et al*., 2010). Known for its fuzzy, moth-like appearance, it is often mistaken for moths (Verheggen *et al*., 2008). Human activity, especially for the transport of infested biological matter (e.g., vegetables), has likely facilitated its spread across the world (Wagner *et al*., 2008). Originally described by Williston (1893), its earliest recorded presence in Europe was in Barcelona, Spain (Tonnoir, 1920).

This study aims to provide updated data on the Psychodinae of Kuwait, which, based on previous literature and this work, includes two species.

Material and methods

Specimens were collected in toilets, showers of locker rooms of public venues, rooms, kitchens, and toilets of private buildings, and the exterior walls of some of these buildings between November 2020 and December 2023 (see list of study sites and fig. 2). Since the initial capture, some of the localities were regularly visited,

sometimes daily. The material was collected with 50 ml centrifuge screw cap tubes and a pooter. All flies appeared conspicuously resting on walls, doors, floors, toilet seats, or sinks. Samples intended to be preserved in liquid solution (70% ethanol), were captured mainly from vertical surfaces through centrifuge tubes filled with no more than 15 ml of the solution. The amount of solution used was enough to avoid spillage if tilting of the tube was necessary during the collection process; once intercepted, the flies hopped in the tube and were forced to drown in the solution. In the lab, these specimens were labelled and transferred to 70% ethanol in 5 × 13 mm screwcap glass tubes. Some specimens were labelled and directly mounted on glass slides using Canada balsam. Individuals sampled with a pooter were carefully transported alive to the lab, killed by freezing, labelled, and point mounted. Selected specimens were photographed with Olympus SZ61 equipped with a digital camera. Male and female genitalia of both species were cleared in KOH and imaged using Accu-Scope 3000-LED and Excelis HD camera, labelled and preserved in micro vials and glycerine.

The material is housed in the Entomology Laboratory of Native Plants Conservation Center at Ardiya Nursery (EL-NPCC-AN), PAAFR, Farwaniyah Governorate, Kuwait City.

External morphology follows Fair (1934), Ježek (1997) and El Bardicy *et al*. (2009) for *Psychoda alternata*, and Williston (1893) and Ježek & Harten (2009) for *Clogmia albipunctata*. Genital morphology is based on Ježek (1977) for *P. alternata*, and Ježek & van Harten (2009) for *C. albipunctata*.

Abbreviations. – **AAA**, Abdali Agricultural Area; **AIA**, Ardiya Industrial Area; **EPA**, Environment Public Authority; **FEC**, Farwaniyah Equestrian Club; **JPR**, Jahra Pool Reserve; **KWGC**, Kuwait Winter Games Club; **NPCC-AN**, Native Plants Conservation Center at Ardiya Nursery; **PAAFR**, Public Authority of Agriculture Affairs and Fish Resources; **SAA**, Sulaibiya Agricultural Area; **SPC**, Swimming Pool Complex; **WAA**, Wafra Agricultural Area.

Study sites. – Five out of 19 study sites were photographed (fig. 7-11), composed of toilets, kitchens, showers, rooms, or exterior walls. Descriptions below define the outside surroundings of these sites.

Ahmadi Governorate. Private farm, WAA, 28°37′58.656″N 48°04′39.936″E, 88 m a.s.l. (fig. 7); the farm is located south of the country near the Kuwait-Saudi border.

Private horse stable, FEC, 29°11′3.703″N 47°48′55.695″E, 59 m a.s.l. (fig. 8); one of 350 racehorse stables in an equestrian club comprising a racecourse, surrounded by open desert.

Japanese Garden, Ahmadi, 29°05′30.372″N 48°04′31.980″E, 94 m a.s.l.; a public park within the city of Ahmadi, built on treated soil.

Palms Agro Production Co., WAA, 28°35′28.500″N 48°04′43.140″E, 99 m a.s.l.; an agriculture retail store.

Rest Area, Dubaiya, 28°55′27.069″N 48°12′22.964″E, 3 m a.s.l.; Dubaiya is an area known for beach chalets and resorts facing the shoreline of the Arabian Gulf and halophytic and wetland habitats.

Al Asimah Governorate. Al-Muthanna Complex, Salhia, Kuwait City, 29°21′58.104″N 47°58′05.340″E, 9 m a.s.l.; a multi-story residential and commercial complex located in central downtown Kuwait City.

Masjid Al-Alim, Sharq, Kuwait City 29°22′49.080″N 47°58′44.472″E, 6 m a.s.l.; rebuilt historic mosque, situated in eastern downtown Kuwait City.

Farwaniyah Governorate. Administration building, Agriculture Research Station, PAAFR, Rabia, 29°17′45.434″N 47°56′39.771″E, 19 m a.s.l. (fig. 9); two-story building

Fig. 7-13. – **7-11**, Five indoor and outdoor sampled places out of 19 study sites: **7**, Exterior wall of building (left) of private farm in WAA (Site 1), 16.III.2023; **8**, FEC horse stable yard showing exterior wall (Site 2), 10.III.2023; **9**, Toilet at PAAFR (Site 8), 15.X.2023; **10**, Salwa residence compound wall (Site 14), 15.III.2023; **11**, Dairy farm toilet and shower (Site 18), 12.IV.2024. – **12-13**, Outdoor and indoor infestations of *Clogmia albipunctata* (Williston): **12**, Several *C. albipunctata* resting on an exterior wall at FEC (Site 2), 17.III.2023; **13**, *C. albipunctata* resting on toilet pipe, at PAAFR (Site 8), 15.X.2023.

located within a ≈767,770 m² area, surrounded by open-field and protected agriculture, livestock, and poultry farming since the 1960s. All the poultry and livestock activities were moved to separate locations in 2008.

Barber shop, Farwaniyah Area, 29°16′41.815″N 47°57′09.249″E, 40 m a.s.l.; urban area consisting of houses, schools, public parks, residential and commercial high-rise buildings.

NPCC-AN, AIA, 29°16′53.386″N 47°55′31.486″E, 23 m a.s.l.; agricultural nursery operated by DRTME, PAAFR for the propagation of native plants in greenhouses and shadehouses. The site includes offices, laboratories and native plant fields, surrounded by residential areas, sports clubs, restaurants, colleges, a hospital, industrial settings as well as patches of unoccupied desert.

Hawalli Governorate. EPA Marine Lab, Ras Al Ard, Salmiya, 29°20′55.637″N 48°06′02.345″E, 4 m a.s.l.; situated near a seaport, a sea club, public beaches, urban landscapes, residential and commercial high-rise buildings overlooking the Arabian Gulf.

KWGC, Bayan, 29°18′09.612″N 48°03′39.924″E, 11 m a.sl.; situated in a residential area surrounded by a commercial zone, schools, mosques, and public parks.

Masjid Alyousefan, Salmiya, 29°19′44.590″N 48°02′48.278″E, 11 m a.s.l.; part of a large urban area of houses, schools, public parks, residential and commercial multi-story buildings.

Private residence, Salwa, 29°17′40.128″N 48°04′26.115″E, 6 m a.s.l. (fig. 10); neighbourhoods comprising of 2- or 3-story buildings, situated near a commercial zone, schools, mosques, and public parks.

SPC, Salmiya, Road 25, 29°20′43.083″N 48°02′39.199″E, 5 m a.s.l.; a public facility, covering a large area with indoor and outdoor pools, showers and changing facilities. The complex is built on the seaside, surrounded by landscaped beachside, a sea club, facing high-rise residential and commercial buildings across Road 25.

Jahra Governorate. Rest area, New Abdali Supermarket, AAA, off Road 80, 29°55′01.992″N 47°40′26.832″E, 36 m a.s.l.; located north of the country and south of the Kuwait-Iraq border overlooking a wide desert.

JPR, Jahra, 29°21′24.368″N 47°41′32.985″E, 5 m a.s.l.; hotspot nature reserve for bird watching, especially migratory species. The site hosts reedbeds grown in man-made pools of treated sewage outfall overlooking Kuwait Bay and north of the Jahra residential and commercial areas off Road 80.

Private dairy farm, SAA, Road 6, 29°16′15.564″N 47°48′25.308″E, 25 m a.s.l. (fig. 11); the farm is part of an agriculture area in central Kuwait where private fodder and dairy farms operate. A large portion of the area is typically unoccupied desert.

Mubarak Al Kabeer Governorate. Restaurant, Sabah Al-Salem, 29°15′25.884″N 48°05′07.368″E, 6 m a.s.l.; situated within a large urban area of houses, mosques, schools, public parks, residential and high-rise commercial buildings.

RESULTS

Clogmia albipunctata (Williston, 1893) (fig. 3-4, 14-22)

Psychoda albipunctata Williston, 1893.

***Material studied*. – Ahmadi Gov.**: Ahmadi: Japanese Garden: 4.III.2023, 1 ♂, 5 ♀. Dubaiya: Rest area: 22.III.2021, 1 ♀. FEC: 2.III.2021, 1 ♂, 7 ♀; 12.IV.2021, 3 ♀; 26.II.2023, 1 ♀; 3.III.2023, 1 ♀; 4.III.2023, 1 ♂, 2 ♀; 5.III.2023, 5 ♀; 6.III.2023, 3 ♀; 9.III.2023, 2 ♂, 8 ♀; 11.III.2023, 2 ♂ 19 ♀; 18.III.2023, 6 ♂, 23 ♀; 22.III.2023, 1 ♂, 15 ♀; 24.III.2023, 6 ♂, 23 ♀; 26.III.2023, 11 ♂, 37 ♀; 7.IV.2023, 3 ♂, 15 ♀; 12.IV.2023, 5 ♀; 5.V.2023, 2 ♀; 12.V.2023, 1 ♂, 9 ♀; 19.V.2023, 1 ♂, 5 ♀; 23.V.2023, 1 ♀; 27.V.2023, 1 ♀; 23.X.2023, 1 ♀; 6.XII.2023, 1 ♀; 7.XII.2023, 5 ♀; 8.XII.2023, 1 ♂, 5 ♀; 10.XII.2023, 2 ♀; 19.XII.2023, 3 ♀; 21.XII.2023, 1 ♂, 1 ♀; 22.XII.2023, 1 ♂, 1 ♀; 23.XII.2023, 1 ♀; 26.XII.2023, 12 ♀. WAA: Private farm: 16.III.2023, 1 ♀. Palms Agro Production Co.: 16.III.2023, 1 ♀. **Al Asimah Gov.**: Kuwait

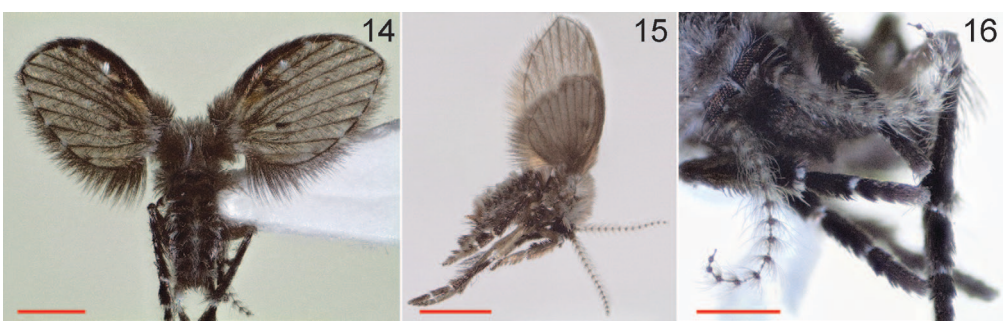

Fig. 14-16. – Three different specimens of *Clogmia albipunctata* (Williston), female, PAAFR, 20.IX.2023. – **14**, Dorsal habitus showing wings, abdomen and part of thorax. – **15**, Lateral habitus, showing thorax hair, abdomen, wings, antennae, and legs with tomentum. – **16**, Verticillate antennae with white hairs and slender tips. Scale bars: 1 mm.

City: Al-Muthanna Complex: 8.XI.2020, 1 ♀. Sharq: Masjid Al-Alim: 26.X.2023, 1 ♀. **Farwaniyah Gov.**: AEA: NPCC-AN: 28.III.2022, 1 ♂; 9.IV.2023, 1 ♀; 15.IV.2023, 1 ♀; 18.IV.2023, 1 ♀; 3.XII.2023, 1 ♀; 11.XII.2023, 1 ♂. Farwaniyah Area: 4.XI.2023, 2 ♀. Rabia: PAAFR Agriculture Research Station: 27.III.2022, 1 ♀; 16.II.2023, 1 ♀; 21.II.2023, 1 ♀; 23.II.2023, 2 ♀; 25.II.2023, 7 ♂; 27.II.2023 1 ♂, 2 ♀; 30.III.2023, 4 ♀; 6.IV.2023, 5 ♂, 19 ♀; 10.IV.2023 2 ♀; 12.IV.2023, 2 ♀; 19.IV.2023, 4 ♂, 29 ♀ ; 20.IV.2023, 1 ♂; 24.IV.2023, 1 ♀; 30.IV.2023, 2 ♂, 2 ♀; 1.V.2023, 3 ♂, 5 ♀; 2.V.2023, 2 ♀; 4.V.2023, 1 ♂, 3 ♀; 7.V.2023, 4 ♀; 9.V.2023, 1 ♂, 3 ♀; 11.V.2023, 1 ♂, 7 ♀; 12.V.2023, 3 ♀; 14.V.2023, 3 ♀; ; 21.V.2023, 1 ♀; 25.V.2023, 1 ♂, 4 ♀; 28.V.2023, 4 ♀; 1.VI.2023, 1 ♂, 1 ♀; 14.VI.2023, 2 ♂, 4 ♀; 8.VI.2023, 1 ♂, 2 ♀; 3.VII.2023, 8 ♀; 12.VII.2023, 1 ♂, 5 ♀; 17.VII.2023, 2 ♂, 10 ♀; 18.VII.2023, 6 ♀; 20.VII.2023, 6 ♀; 25.VII.2023, 1 ♂, 3 ♀; 28.VII.2023, 4 ♀; 7.VIII.2023, 15 ♀; 10.VIII.2023, 1 ♂, 8 ♀; 21.VIII.2023, 7 ♀; 31.VIII.2023, 2 ♀; 5.IX.2023, 2 ♀; 14.IX.2023, 1 ♂, 3 ♀; 20.IX.2023, 3 ♀; 21.IX.2023, 4 ♀; 24.IX.2023, 4 ♂, 9 ♀; 25.IX.2023, 1 ♂, 2 ♀; 26.IX.2023, 1 ♂, 3 ♀; 1.X.2023, 1 ♀; 5.X.2023, 18 ♂, 44 ♀; 8.X.2023, 15 ♂, 15 ♀; 9.X.2023, 1 ♂, 2 ♀; 10.X.2023, 1 ♂, 4 ♀; 12.X.2023, 3 ♀; 19.X.2023, 1 ♀; 2.XI.2023, 1 ♂, 9 ♀; 7.XI.2023, 1 ♂, 4 ♀; 9.XI.2023, 1 ♂; 26.XI.2023, 1 ♂, 2 ♀; 28.XI.2023, 4 ♀; 30.XI.2023, 3 ♂, 3 ♀; 2.XII.2023, 6 ♀; 5.XII.2023, 2 ♂, 3 ♀; 6.XII.2023, 1 ♂, 4 ♀; 10.XII.2023, 5 ♀; 13.XII.2023, 1 ♀; 14.XII.2023, 1 ♂, 1 ♀; 16.XII.2023, 1 ♂, 4 ♀; 18.XII.2023, 2 ♂, 8 ♀; 21.XII.2023, 1 ♂, 2 ♀; 24.XII.2023, 2 ♂, 4 ♀; 25.XII.2023, 2 ♂, 5 ♀; 26.XII.2023, 6 ♂, 4 ♀. **Hawalli Gov.**: Bayan: KWGC: 25.IX.2022, 1 ♂. Ras Al-Ard: EPA Marine Lab: 6.III.2021, 2 ♀; 2.V.2021, 1 ♂; 5.VI.2021, 1 ♀. Salmiya: Masjid Alyousefan: 15.II.2022, 2 ♀. Salwa: 20.III.2023, 1 ♂; 12.IV.2023, 1 ♀; 18.IV.2023, 1 ♀; 19.IV.2023, 1 ♀; 30.X.2023, 1 ♀. SPC: 19.VIII.2023, 2 ♀; 30.VIII.2023, 1 ♂, 1 ♀; 18.XI.2023, 1 ♂; 2.XII.2023, 2 ♂, 6 ♀; 9.XII.2023, 4 ♂,18 ♀; 23.XII.2023, 6 ♂, 11 ♀. **Jahra Gov.**: Abdali: New Abdali Supermarket, 17.III.2021, 1 ♀. Jahra: JPR, 6.III.2021, 1 ♂. SAA: dairy farm, 7.I.2022, 1 ♀; 18.XI.2023, 1 ♀; 8.XII.2023, 1 ♀; 22.XII.2023, 1 ♀. **Mubarak Al Kabeer Gov.**: Sabah Al-Salem: Restaurant, 15.VI.2021 1 ♀.

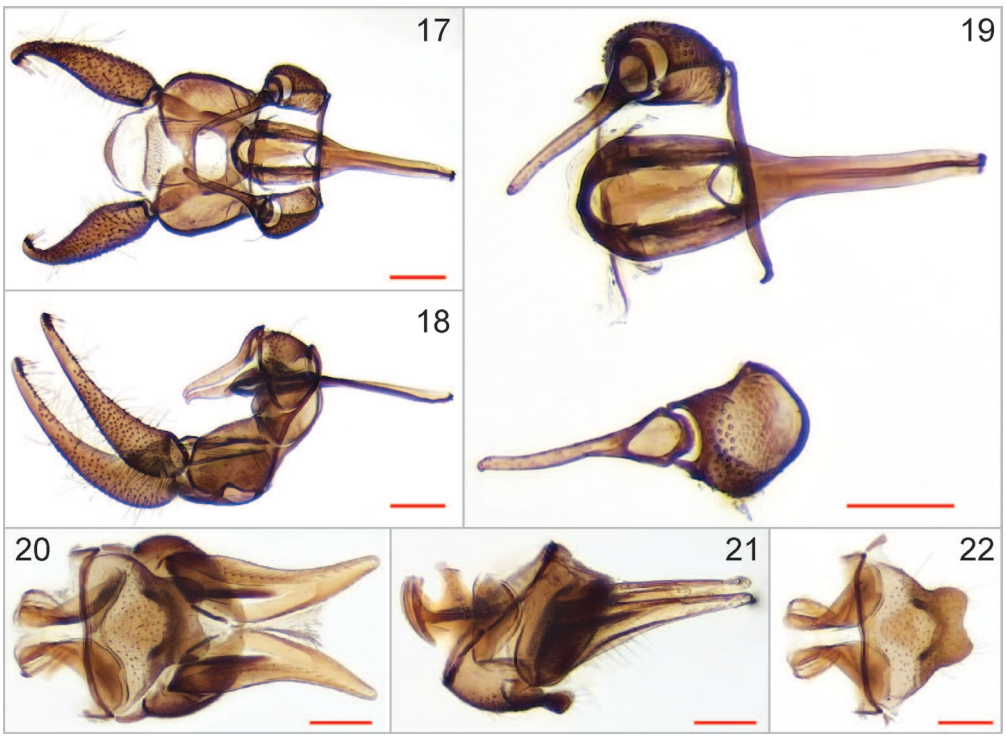

Fig. 17-22. – *Clogmia albipunctata* (Williston). – **17-19**, Male: **17-18**, terminalia (**17**, dorsal view; **18**, lateral view); **19**, aedeagal complex and left gonopod, dorsal view, right gonopod separated. – **20-22**, Female: **20-21**, terminalia (**20**, ventral view: genital chamber, subgenital plate, and cerci; **21**, lateral view showing 9th tergite); **22**, subgenital plate and genital chamber, ventral view. Scale bars: 0.02 mm.

Remarks. – New species for the fauna of Kuwait. When at rest, *Clogmia albipunctata* individuals hold their wings flat (fig. 3-4). The wings are characteristically broad, lancet-shaped, 2.2 mm in size, covered in black and brown hairs and two black hair tufts at furcation and a white tuft of hair at the anterior furcation (fig.14). The ground colour of the abdomen is blackish luteous with profuse greyish, brownish, and black erect hairs (fig. 14-15). The thorax has thick brownish grey hair (fig. 15). Antennae are long with white hairs, verticillate, have thickened basal joints and are slender at tips (fig. 15-16). Legs with brown tomentum and white thin rings at tibiae and metatarsi tips (fig. 15).

Clogmia albipunctata can also be recognized by genital morphology. Male terminalia (fig. 17-18) include short, separated gonocoxites, shorter than gonostyli, gonostyli lack tubercles subapically (fig. 17, 19). The aedeagal complex consists of two small converging and pointed external protuberances (fig. 19). Female terminalia (fig. 20-21) exhibit a distinguishable subgenital plate (fig. 22).

Psychoda alternata (Say, 1824) (fig. 5-6, 23-31)

Tinearia alternata Say, 1824.

Material studied. – **Ahmadi Gov.**: FEC: 29.XII.2023, 1 ♀; 31.XII.2023, 11 ♀. **Hawalli Gov.**: Salmiya: SPC: 19.VIII.2023, 1 ♂; 30.IX.2023, 1 ♂; 3.X.2023, 1 ♂; 7.X.2023, 3 ♂, 1 ♀; 10.X.2023, 2 ♂; 2.XII.2023, 2 ♂; 9.XII.2023, 4 ♂; 23.XII.2023, 5 ♂, 2 ♀. Masjid Alyousefan: 15.II.2022, 1 ♂. **Farwaniyah Gov.**: Rabia: PAAFR Agriculture Research Station: 18.XII.2023, 1 ♂; 24.XII.2023, 1 ♂. **Jahra Gov.**: SAA: dairy farm: 30.IX.2023, 1 ♂, 1 ♀; 10.X.2023, 4 ♂, 1 ♀; 27.X.2023, 1 ♂, 1 ♀; 15.XII.2023, 3 ♂, 4 ♀; 22.XII.2023, 1 ♂, 7 ♀.

Remarks. – *Psychoda alternata* is described as small, triangular in shape, ranging from 3-5 mm, yellowish with long dark grey body hair (fig. 23). Wings, milky clouded, reach 2-3 mm, densely haired around the veins in some areas causing them to appear mottled, having noticeable dark brown tufts of hair at the tips of veins (fig. 23). When spotted at rest, specimens typically hold wings folded at an angle (fig. 5-6). The species has long antennae consisting of 12-15 segments (fig. 24).

The male terminalia of *Psychoda alternata* (fig. 25-29) have harpagones appearing blade-shaped and distinctly extended laterally, slightly longer than coxopodits which

Fig. 23-24. – *Psychoda alternata* (Say), male. – **23**, Lateral habitus showing dark grey body hair and mottled wings, SPC (Site 15), 30.IX.2023. – **24**, Antennae segments, SPC (Site 15), 9.IX.2023. Scale bars: 1 mm.

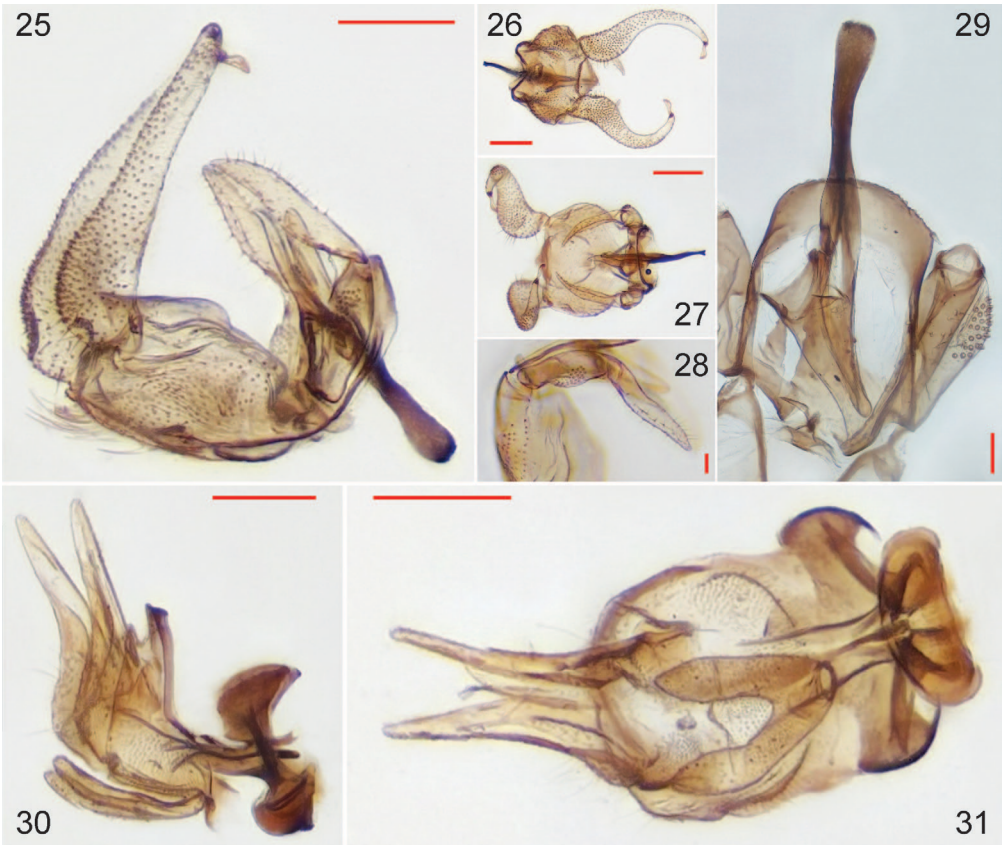

Fig. 25-31. – *Psychoda alternata* (Say). – **25-29**, Male: **25-26**, terminalia (**25**, lateral view; **26**, ventral view); **27**, dorsal view of terminalia exposing aedeagal complex; **28**, coxopodits and harpagones, lateral view; **29**, aedeagus, ventral view. – **30-31**, Female, terminalia: cerci, genital plate, and genital chamber: **30**, lateral view; **31**, ventral view. Scale bars: 0.02 mm, except fig. 28, 0.005 mm.

show noticeable protuberance externally (figs. 25, 28). Cerci shaped like S ventrally, having one retinaculum on the apex (fig. 26). The apodeme of the genitalia is slightly curved basally, divided apically (fig. 29). The terminalia of the female is characterized by a complex genital chamber consisting of three pairs of winged processes (posterior pair, a pair of dorsal projections and an unpaired ventral part with distinct internal structures) (fig. 30-31). The subgenital plate is typically U-shaped (fig. 31).

Discussion

Infestations primarily occurred in toilets, showers, kitchens and rooms (fig. 9, 11), with occasional observations on exterior walls at some sites (table III) (fig. 7-8, 10). *Clogmia albipunctata* was observed both indoors and outdoors (fig. 3-4, 12-13), while *Psychoda alternata* was observed only indoors (fig. 5-6). It is likely that *Clogmia albipunctata* individuals observed outdoors escaped through open windows of toilets and kitchens nearby. These outdoor observations were limited to the cooler winter and spring months, during which adults could tolerate the exterior conditions and rest on outdoor walls. Notably, during Kuwait's extreme summer and hot autumn months,

adults of both species were observed exclusively indoors across the country, likely due to air conditioning providing a cooler environment that allows them to survive in these buildings, as they cannot endure the outdoor heat. This pattern also supports their direct association with sewer systems in Kuwait, from which individuals are

Table III. – Sampling of *Clogmia albipunctata* (Williston) and *Psychoda alternata* (Say) indoors (toilets, kitchens, rooms) and outdoors (exterior walls) in 19 urban and agricultural sites of six governorates. (*) Due to the nature of the sampled habitat, zone type has no significant biological value. (-) no presence.

Study Site	Governorate	Zone type *	*Clogmia albipunctata*	*Psychoda alternata*
1	Ahmadi	Agriculture	Outdoors	-
2	Ahmadi	Agriculture	Indoors & outdoors	Indoors
3	Ahmadi	Urban	Indoors	-
4	Ahmadi	Agriculture	Indoors	-
5	Ahmadi	Urban	Indoors	-
6	Al Asimah	Urban	Indoors	-
7	Al Asimah	Urban	Indoors	-
8	Farwaniyah	Urban/Agriculture	Indoors & outdoors	Indoors
9	Farwaniyah	Urban	Indoors	-
10	Farwaniyah	Urban/Agriculture	Indoors	-
11	Hawalli	Urban	Indoors	-
12	Hawalli	Urban	Indoors	-
13	Hawalli	Urban	Indoors	Indoors
14	Hawalli	Urban	Indoors & outdoors	Indoors
15	Hawalli	Urban	Indoors	Indoors
16	Jahra	Agriculture	Indoors	-
17	Jahra	Urban	Indoors	-
18	Jahra	Agriculture	Indoors	Indoors
19	Mubarak Al Kabeer	Urban	Indoors	-

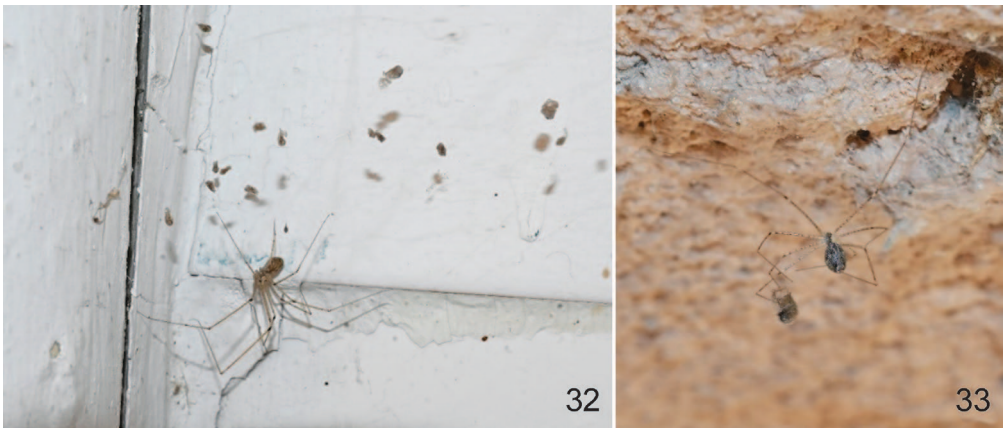

Fig. 32-33. – Cellar spiders *Pholcus* spp. (Pholcidae) preying on *Clogmia albipunctata* (Williston) and *Psychoda alternata* (Say). – **32**, Several *P. alternata* trapped in Cellar spider web in the corner of a room (Site 18), 12.I.2024. – **33**, On exterior wall (Site 2), *C. albipunctata* wrapped up in spider's appendages after being captured midflight, 23.IV.2024.

released into buildings. Due to the methodology used and the small size of *P. alternata*, surveying for infestations on nearby exterior walls was less effective compared to the larger and more conspicuous *Clogmia albipunctata*. Additionally, as noted by Marshall (2012), *P. alternata* is frequently observed in domestic environments than *C. albipunctata*, aligning with the findings of this study, where *C. albipunctata* was significantly more common across all sites. Furthermore, in some sites, individuals of both species were observed as prey to cellar spiders, *Pholcus* sp. (Araneae: Pholcidae) (fig. 32-33).

Although *C. albipunctata* as newly reported for Kuwait, a sampling error noted in Al-Mesbah's (2011) research suggests an earlier presence of the species. In that study, Al-Mesbah intended to identify *P. alternata* based on morphological description but inadvertently overlooked the presence of *C. albipunctata* in the process. Based on this finding, it appears that both species coexisted in the country at the time. In addition, an even earlier observation was reported by Hamed Al-Shatti, a colleague from the PAAFR, who recalls numerous *C. albipunctata* individuals in the shower stall of his family home between 1999 and 2000 (pers. comm).

While it is difficult to make a direct comparison due to differences in study sites, methods, and the distinct ecology of Kuwait versus UAE, eight species of Psychodinae were documented in the UAE (Ježek & van Harten, 2009). It is likely that Kuwait's Psychodinae diversity also extends beyond the two species currently recorded or their association with anthropogenic habitats. Extensive surveys across natural habitats using passive sampling techniques (Malaise and light traps, for example) could significantly expand the understanding of this fauna. Potential breeding sites, such as agricultural fields surrounding manmade ponds, stagnant water, high organic content such as manure and plant material, and wetland habitats along the shoreline, although limited, are particularly worthy of investigation. Although the country's arid climate could constrain biodiversity —especially in specialist taxa—, focused research during the cooler winter and spring seasons may reveal additional diversity.

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