

**ZOOLOGIYA INSTITUTI HUZURIDAGI ILMIY DARAJALAR
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O‘ZBEKISTON MILLIY UNIVERSITETI

ELMURODOVA MUHAYYO VALIQUL QIZI

**MARKAZIY O‘ZBEKISTON ASALARISIMONLARI (HYMENOPTERA:
APOIDEA) FAUNASI, EKOLOGIK XUSUSIYATLARI VA AHAMIYATI**

03.00.06 – Zoologiya

**BIOLOGIYA FANLARI BO‘YICHA FALSAFA DOKTORI (PhD)
DISSERTATSIYASI AVTOREFERATI**

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**BIOLOGIYA FANLARI BO‘YICHA FALSAFA DOKTORI (PhD) DISSERTATSIYASI
AVTOREFERATI**

Biologiya fanlari bo'yicha falsafa doktori (PhD) dissertatsiyasi mavzusi O'zbekiston Respublikasi Oliy ta'lim, fan va innovatsiyalar vazirligi huzuridagi Oliy attestatsiya komissiyasida B2022.2.PhD/B743 raqam bilan ro'yxatga olingan.

Dissertatsiya O'zbekiston Milliy universitetida bajarilgan.

Dissertatsiya avtoreferati uch tilda (o'zbek, ingliz, rus (rezyume)) Ilmiy kengash veb sahifasi (www.izoology.uz) hamda «ZiyoNet» Axborot-ta'lim portalida (www.ziynet.uz) joylashtirilgan.

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Dissertatsiya avtoreferati 2025-yil «25» iyul kuni tarqatildi.

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KIRISH (falsafa doktori (PhD) dissertatsiyasi annotatsiyasi)

Dissertatsiya mavzusining dolzarbligi va zarurati: Dunyo miqyosida tabiiy ekotizim va hasharotlar xilma-xilligini saqlash hozirgi ekologik muammolar sharoitida juda dolzarbdir. Inson faoliyati natijasida tabiiy landshaftlar o'zgarib, o'simlik va hayvonot dunyosi, xususan, hasharotlar yashash muhitidan mahrum bo'lmoqda, bu esa ekotizim muvozanatiga salbiy ta'sir ko'rsatadi. Hasharotlar yer yuzidagi ekotizimlarning muhim tarkibiy qismlaridan bo'lib, ular changlanish, ozuqa zanjiri, organik moddalarning parchalanishi kabi jarayonlarda muhim rol o'ynaydi. Ammo insonning agrar faoliyati, sanoat inshootlari va o'rmonlarning kesilishi natijasida hasharotlar yashash muhitlari kamayib, ko'plab turlar xavf ostiga tushmoqda. Shunga ko'ra, tabiiy va antropogen ekotizimlarda entomofaunaning muhim guruhlaridan biri bo'lgan asalarisimonlarning zamonaviy holatini baholash, ularning faunistik tarkibini tahlil qilish, tarqalish xususiyatlari, ekologiyasi va zoogeografiyasini o'rganish, shuningdek, xo'jalikdagi ahamiyatini ochib berish muhim ahamiyat kasb etadi.

Jahon miqyosida hasharotlarning muhim guruhlaridan biri bo'lgan asalarisimonlarning hozirgi kundagi holatini baholash, faunistik tarkibini tahlil qilish, tarqalishi, xo'jalik ahamiyati va zararini o'rganishga doir ilmiy izlanishlar olib borilmoqda. Bu borada, jumladan har yili yangi tur va kenja turlar kashf etilib, ko'plab turlarning sistematik holatiga o'zgartirishlar kiritilib borilmoqda, yo'qolib ketayotgan va kam uchraydigan turlarlarning tarqalish hududlarini aniqlash va ularni muhofaza qilish choralarini ishlab chiqish bo'yicha alohida e'tibor qaratilmoqda.

Respublikamizda hasharotlar bioxilma-xilligini aniqlash, ularni himoya qilish va zararli turlariga qarshi kurashish chora-tadbirlariga alohida e'tibor qaratilmoqda. Bu borada, hududlar o'rtasida tabiiy ekotizimlarning barqarorligini ta'minlash, kamyob va yo'qolib borayotgan turlarni saqlash bo'yicha tadbirlar amalga oshirilmoqda. Xususan, 2019-2028 - yillar davrida O'zbekiston Respublikasida biologik xilma-xillikni saqlash strategiyasida¹ "...biologik xilma-xillikni saqlash va undan barqaror foydalanishni ta'minlash, muhofaza qilinadigan tabiiy hududlarni rivojlantirish va kengaytirish, tabiiy ekologik tizimlarning tanazzulga uchrash sur'atlarini pasaytirish, hayvonlar va o'simliklarning kamyob va yo'qolib borayotgan turlarini qayta tiklash" vazifalari belgilangan. Ushbu vazifalar asosida, respublikada asalarisimonlarning tur tarkibini aniqlash, ekologik xususiyatlarini tahlil qilish va tarqalishini o'rganish muhim ilmiy ahamiyatga ega. Shuningdek, kamyob turlarni himoya qilish va ularning yashash muhitlarini tiklash bo'yicha amaliy chora-tadbirlar ishlab chiqish muhim ilmiy va amaliy ahamiyat kasb etadi.

O'zbekiston Respublikasi Prezidentining 2022 yil 28 yanvardagi PF-60-son "2022-2026 yillarga mo'ljallangan yangi O'zbekistonning taraqqiyot strategiyasi to'g'risida"gi Farmoni, O'zbekiston Respublikasi Vazirlar Mahkamasining 2018 yil 7 noyabrda 914-son "Hayvonot va o'simlik dunyosi ob'ektlarining davlat hisobini, ulardan foydalanish hajmlari hisobini va davlat kadastrini yuritish to'g'risida"gi qarori, O'zbekiston Respublikasi Vazirlar Mahkamasining 2019 yil 11 iyundagi 484-

¹ O'zbekiston Respublikasi Vazirlar Mahkamasining "2019-2028 yillar davrida O'zbekiston Respublikasida biologik xilma-xillikni saqlash strategiyasini tasdiqlash to'g'risida" 2019 yil 11 iyundagi 484-son qarori.

son “2019-2028 yillar davrida O‘zbekiston Respublikasida biologik xilma-xillikni saqlash strategiyasini tasdiqlash to‘g‘risida”gi qarori hamda boshqa tegishli me‘yoriy-huquqiy hujjatlar doirasida belgilangan vazifalarni amalga oshirishga ushbu dissertatsiya tadqiqoti o‘zining ilmiy va amaliy jihatlari bilan muayyan darajada xizmat qiladi.

Tadqiqotning respublika fan va texnologiyalari rivojlanishining ustuvor yo‘nalishlarga mosligi. Mazkur tadqiqot respublika fan va texnologiyalar rivojlanishining V. “Qishloq xo‘jaligi, biotexnologiya, ekologiya va atrof muhitni muhofazasi” ustuvor yo‘nalishiga muvofiq bajarilgan.

Muammoning o‘rganilganlik darajasi: Asalarisimonlar (Hymenoptera: Apoidea) bo‘yicha ilmiy tadqiqotlar bir qancha jahon olimlari tomonidan olib borilgan, jumladan, P.A.Latreille (1802), A.Becker (1866), F.F.Kohl (1885, 1896, 1901), G.Melo (1999), A.V.Antropov (1994), M.Y.Proshchalykin (2005), T.V.Levchenko (2010), Yu.N.Danilov (2012, 2013, 2014), P.G.Nemkov (2008, 2012, 2013, 2016, 2017), O.I.Borodin (2015), K.I.Shorenko (2020), V.L.Kazenas (2014), İ.Can, Y.Gülmez (2021), Ch.Schmid-Egger (2021) va boshqalar tomonidan bayon etilgan.

MDH davlatlari asalarisimonlari (Hymenoptera: Apoidea)ning tadqiqotlarining tahlili N.S.Borxsenius (1962), V.V.Popov (1967), V.L.Kazenas (1984) tomonidan olib borilgan bo‘lib, mualliflar turli asalarisimonlar (Hymenoptera: Apoidea)ning faunistik tahlili va ekologiyasi, shuningdek qishloq xo‘jaligi ekinlariga zarar keltirishi bilan bog‘liq masalalarga e‘tibor qaratgan. Markaziy Osiyo asalarisimonlarining A.G.Davletchina (1979), M.V.Mokrousov, A.V.Shestakov (1918), V.V.Gussakovskiy (1927, 1935), S.N.Myarseva (1963-1972), S.G.Gayubo (2003), Sh.D.Nazarova (2004, 2005), V.L.Kazenas (1965-2014), V.A.Zryanin (2015)lar tomonidan o‘rganilgan.

O‘zbekistonda mazkur sohada ilk bor O.I.Radoshkovskiy (1877) ilmiy izlanishlarni boshlagan. A.V.Shestakov (1917), V.V.Gussakovskiy (1927, 1928, 1930, 1933, 1935, 1936, 1937, 1952), W.J.Pulawski (1971), Sh.Islamov (1971, 1979, 1983, 1986), A.G.Davletshina (1979), A.V.Antropov (1994), T.T.Kulumbetova (1999), P.G.Nemkov (2016), R.Murao, O.Tadauchi va R.Miyanaga (2017), M.V.Mokrousov (1993, 1995, 2014, 2015, 2017, 2019, 2020) Y.N.Danilov (2018, 2020), M.A.Embergenovlar (2024) sohaning rivojlanishiga katta hissa qo‘shgan va zamonaviy ilmiy muammolarni o‘rgangan.

Biroq, yuqorida keltirilgan ilmiy tadqiqot natijalari O‘zbekistonda amalga oshirilgan bo‘lsada, Markaziy O‘zbekiston miqyosidagi asalarisimonlar (Apoidea) haqida to‘liq ma‘lumot bera olmaydi. Shunga sababli, asalarisimonlarning tur tarkibini aniqlash, muhofaza qilish choralari ishlab chiqish, turli biotoplarda tarqalishi, zoogeografiyasi, keng va kam tarqalgan turlarini o‘rganish hamda ekologik xususiyatlarini ochib berish muhim ilmiy - amaliy ahamiyat kasb etadi.

Tadqiqotning dissertatsiya bajarilgan oliy ta‘lim muassasasining ilmiy-tadqiqot ishlari rejalari bilan bog‘liqligi. Dissertatsiya tadqiqoti O‘zbekiston Milliy universiteti Zoologiya kafedrasining ilmiy-tadqiqot ishlari rejasiga muvofiq “O‘zbekiston hayvonot olami bioxilma-xilligini o‘rganish va muhofaza qilish” (2021-2023 yy) mavzusidagi ilmiy tadqiqot dasturi doirasida bajarilgan.

Tadqiqotning maqsadi: Markaziy O‘zbekiston asalarisimonlarining faunasi, zamonaviy tur tarkibini aniqlash, tarqalish areallarini belgilash, ekologik xususiyatlari va xo‘jalik ahamiyatini ochib berishdan iborat.

Tadqiqotning vazifalari:

Markaziy O‘zbekiston asalarisimonlarining faunasi va tur tarkibini aniqlash;
Markaziy O‘zbekiston asalarisimonlarning hududlar bo‘yicha tarqalishini qiyoslash;

Asalarisimonlarning ekologik xususiyatlarini tahlil etish;

Asalarisimonlarning Markaziy O‘zbekiston hududlarini landshaftlarga bo‘lib o‘rganish;

Asalarisimonlarning zoogeografik tarqalishini tahlil qilish;

Asalarisimonlarning xo‘jalikdagi ahamiyatini aniqlashdan iborat.

Tadqiqotning obyekti sifatida Markaziy O‘zbekiston asalarisimonlarining (Hymenoptera: Apoidea) turlari olingan.

Tadqiqotning predmetini Asalarisimonlarning taksonomik va faunistik tahlili, ularning ekologik xususiyatlari, Markaziy O‘zbekiston hududida landshaftlarda tarqalishi hamda xo‘jalikdagi ahamiyati tashkil etgan.

Tadqiqotning usullari: Dissertatsiyada zoologik, entomologik, ekologik, molekulyar-genetik, zoogeografik hamda statistik usullaridan foydalanilgan.

Tadqiqotning ilmiy yangiligi quyidagilardan iborat:

ilk bor Markaziy O‘zbekistonning tabiiy va antropogen landshaftlarida tarqalgan pardaqaotli hasharotlarning tur tarkibi tahlil qilinib, 8 ta oila, 21 ta kenja oila, 52 avlodga mansub 142 turi aniqlangan;

ilk bor O‘zbekiston faunasi uchun Sphecidae oilasiga mansub *Prionyx melanotus* turi hamda Markaziy O‘zbekiston hududida asalarisimonlarning 5 ta oila 18 ta avlodga mansub 21 ta turi aniqlangan;

Markaziy O‘zbekiston hududida asalarisimonlar bosh oilasi *Stizus* Latreille, 1802 avlodiga mansub 1 ta tur (*Stizus handlirschi*) ning taksonomik o‘rni molekular-genetik tahlillar asosida isbotlangan;

Asalarisimonlar faunasining 4 ta biotoplar bo‘yicha tarqalishi isbotlangan, aniqlangan turlar tarqalishi va yashash joylariga ko‘ra zoogeografik tahlil qilinib 13 ta guruhga ajratilgan.

Tadqiqotning amaliy natijalari quyidagilardan iborat:

Markaziy O‘zbekiston hududida, xususan Navoiy, Buxoro, Samarqand va Jizzax viloyatlarida o‘tkazilgan tadqiqotlar, asalarisimonlar faunasini o‘rganishga qaratilgan. Ushbu tadqiqotlar natijasida, hududda tarqalgan asalarisimonlar turlarining ro‘yxati tuzilgan va ularning biologiyasi, ekologiyasi, tarqalish xususiyatlari aniqlangan.

Tadqiqotlarning muhim yutuqlaridan biri shundaki, ushbu ma’lumotlar “Catalog of Sphecidae” nomli xalqaro ilmiy nashrda e’lon qilingan. Bu esa Markaziy O‘zbekistonning asalarisimonlar faunasiga oid ilmiy ma’lumotlardan dunyo miqyosida foydalanish imkonini yaratadi.

Tadqiqotlar asalarisimonlar turlarining ekologik va biologik xususiyatlarini yanada chuqurroq tahlil etish, shuningdek, ularning muhofazasi va ekologik ahamiyatini ta’minlashda asos bo‘lib xizmat qiladi.

Tadqiqot natijalarining ishonchliligi tadqiqotda qo'llanilgan zoologik usul va yondashuvlar asosida olingan tajriba natijalarini nazariy ma'lumotlarga mos kelishi, morfometrik ma'lumotlarni zamonaviy dasturlar asosida (Microsoft Office Excel, 2010; EXLSTAT 2010, Morpho J; ArcGIS;) statistik tahlil qilingani, dissertatsiya natijalari xorijiy jurnallarda chop etilganligi hamda ishlab chiqilgan tavsiyalarining amaliyotga tatbiq etilganligi bilan izohlanadi.

Tadqiqot natijalarining ilmiy va amaliy ahamiyati. Tadqiqot natijalarining ilmiy ahamiyati Markaziy O'zbekiston asalarisimonlari faunasini to'la tahlil qilinganligi va populyatsiyalari tarqalishining zamonaviy holati baholanganligi, yangi turlarning qayd qilinganligi va ekologiyasining o'ziga xos xususiyatlari yoritilganligi bilan izohlanadi.

Tadqiqot natijalarining amaliy ahamiyati Markaziy O'zbekiston hududidagi asalarisimonlarning ma'lumotlar bazasini ishlab chiqilganligi, ularning hudud bo'yicha tarqalishi, ekologik sharoitga moslanish xususiyatlari, biologik xilma-xilligi va muhim changlatuvchi turlar to'g'risidagi tahliliy ma'lumotlarning umumlashtirilganligi hamda Markaziy O'zbekiston asalarisimonlarining tarqalishi, bioekologik xususiyatlari oid tadqiqot natijalari "Catalog of Sphecidae" ga joylashtirilganligi bilan asoslanadi.

Tadqiqot natijalarining joriy qilinishi. Markaziy O'zbekiston asalarisimonlari (Apoidea): taksonomiyasi, ekologik xususiyatlari va tarqalishi yuzasidan olingan ilmiy natijalar asosida:

Apoidea bosh oilasiga tegishli 8 oila, 17 kenja oila, 40 avlod 74 turga mansub asalarisimonlarning 74 nusxa hasharot namunalari Respublikada yetakchi bo'lgan "Zoologiya kolleksiyasi" noyob ob'ektiga kiritilgan (O'zbekiston Respublikasi Fanlar akademiyasining 2024 - yil 11 - dekabrda № 4/1255 - 2749 son ma'lumotnomasi). Natijada, namunalar hasharotlar kolleksiyasi fondini boyitgan va tur tarkibini aniqlash uchun solishtirish, qiyosiy tahlil etish hamda biotoplar bo'yicha taqsimlanishni tahlil qilish va atlas tayyorlashda foydalanish imkonini bergan;

Markaziy O'zbekiston hududidan yig'ilgan *Stizus handlirschi* asalari turining mitoxondrial DNK (COX1) sohasi nukleotidlar ketma-ketligi bo'yicha olingan ma'lumotlar Biotenologik Axborotlar Milliy Markazi bazasiga (NCBI, Milliy biotexnologiya axborot markazining 2024 - yil 30 - aprel oyidagi ma'lumotnomasi) joylashtirilgan. Natijada *Stizus handlirschi* asalarisining PP726882 identifikatsiya raqami olingan. va ushbu asalari turini molekulyar taksonomik va filogenetik o'rnini asoslash imkonini bergan.

Tadqiqot natijalarining aprobatyasi. Mazkur tadqiqot natijalari 4 ta xalqaro va 5 ta respublika ilmiy-amaliy anjumanida muhokamadan o'tkazilgan.

Tadqiqot natijalarining e'lon qilinishi. Dissertatsiya mavzusi bo'yicha jami 16 ta ilmiy ish chop etilgan, shulardan, O'zbekiston Respublikasi Oliy attestatsiya komissiyasining doktorlik dissertatsiyalari asosiy ilmiy natijalarini chop etish uchun tavsiya etilgan ilmiy nashrlarda 7 ta maqola, jumladan, 3 tasi respublika va 4 tasi xorijiy ilmiy jurnallarda nashr etilgan.

Dissertatsiyaning tuzilishi va hajmi. Dissertatsiya tarkibi kirish, 5 ta bob, xulosalar, foydalanilgan adabiyotlar ro'yxati va ilovalardan iborat. Dissertatsiyaning

hajmi 120 betni tashkil etadi.

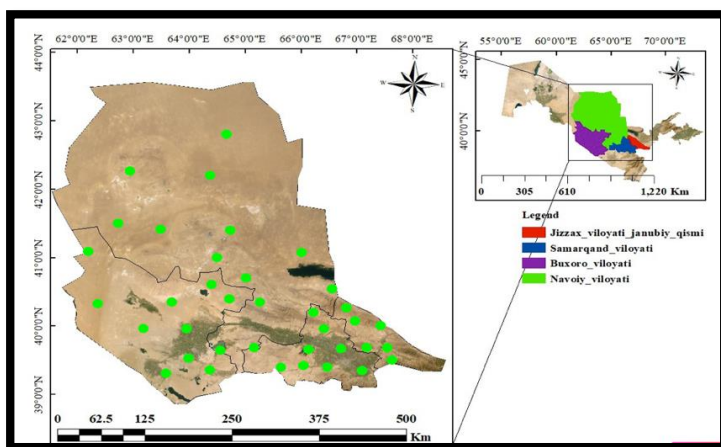
DISSERTATSIYANING ASOSIY MAZMUNI

Kirish qismida mavzuning dolzarbligi va zarurati asoslangan, tadqiqotning maqsadi va vazifalari, obyekt va predmetlari tavsiflangan, O‘zbekiston respublika fan va texnologiyalari rivojlanishining ustuvor yo‘nalishlarga mosligi ko‘rsatilgan, muammoning o‘rganilganlik darajasi yoritilgan, tadqiqotning ilmiy yangiligi va amaliy natijalari bayon qilingan, olingan natijalarining ilmiy va amaliy ahamiyati ochib berilgan, tadqiqot natijalarining joriy qilinishi, nashr etilgan ishlar va dissertatsiya tuzilishi bo‘yicha ma‘lumotlar keltirilgan.

Dissertatsiyaning **“Markaziy O‘zbekiston asalarisimonlarning (Hymenoptera: Apoidea) o‘rganilish holati”** deb nomlangan birinchi bobi ikki qismidan iborat bo‘lib, unda jahonda, MDH davlatlari va O‘zbekistonda asalarisimonlar turlarini o‘rganish bo‘yicha olib borilgan tadqiqotlarning tavsifi to‘g‘risida ma‘lumotlar keltirilgan. Bunda ko‘tarilgan mavzu o‘rganilishining bugungi holati, asalarisimonlar turlarining o‘rganilish tarixi, faunasi, biologiyasi, zoogeografiyasi va ekologiyasi bo‘yicha olib borilgan tadqiqotlar o‘z ifodasini topgan. Apoidea katta oilasini o‘rganishga oid hozirga qadar olib borilgan ilmiy tadqiqotlar natijalari to‘g‘risida batafsil ma‘lumotlar keltirilgan. Mavjud materiallar Markaziy O‘zbekiston asalarisimonlarining hozirgi holati va ekologik xususiyatlari to‘g‘risida xulosalar chiqarish uchun yetarli emasligi aniqlangan.

Dissertatsiyaning **«Markaziy O‘zbekiston asalarisimonlari (Hymenoptera: Apoidea) faunasi, ekologik xususiyatlari va ahamiyatini o‘rganish uslublari va materialli»** deb nomlangan ikkinchi bobi ikki bo‘limdan iborat bo‘lib, ushbu bobda asalarisimonlarning Markaziy O‘zbekiston hududlarida tarqalishi yoritilgan. Tadqiqot davomida Markaziy O‘zbekiston bo‘ylab turli joylardan 14 ta tadqiqot maydoni tanlab olingan

Markaziy O‘zbekiston asalarisimonlarining tarqalish hududlari to‘g‘risida GAT xaritalari tuzilgan. Hududlarning koordinatalari Maps.me ilovasi orqali aniqlanib, ArgGIS Pro dasturi yordamida xaritalari tuzilgan hamda ma‘lumotlar bazasiga kiritilgan (1-rasmga qarang).



1-rasm. Asalarisimonlarning Markaziy O‘zbekiston hududidan yig‘ilgan koordinatalarining xaritasi

Markaziy O‘zbekiston viloyatlari asalarisimonlarining tur tarkibining o‘zaro o‘xshashligini aniqlash uchun Chao maqolasida ko‘rsatilgan P. Jakkard indeksidan foydalanildi.

$$K_j = \frac{c}{a+b-c}$$

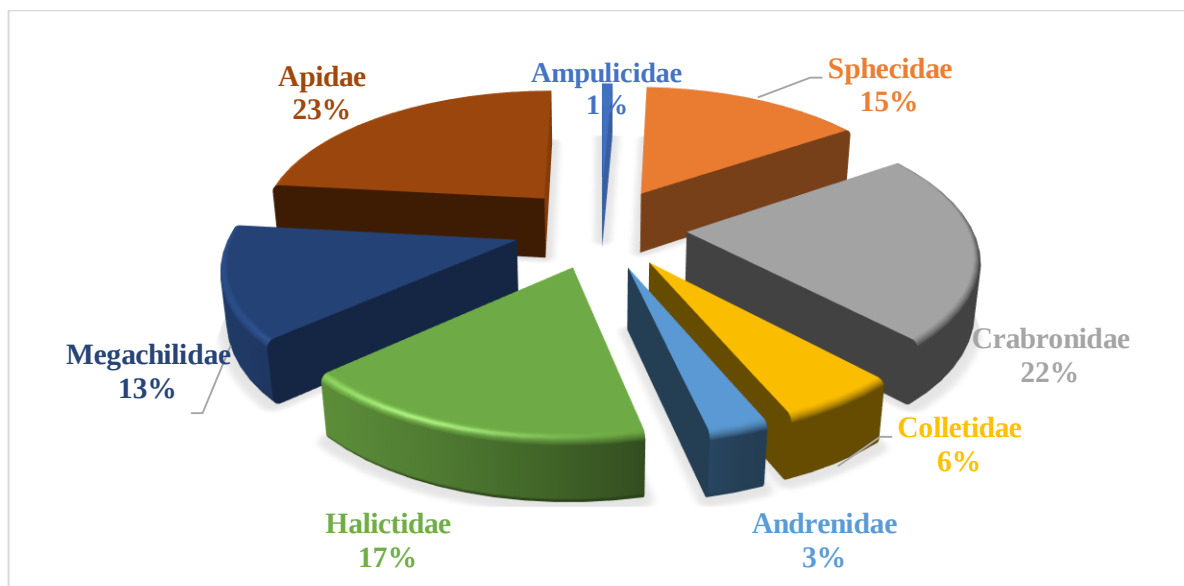
Bu yerda a va b taqqoslangan biotsenozlarning har birida topilgan turlar soni, c – ular uchun umumiy turlar soni.

Sturgess formulasi asosida Markaziy O‘zbekistonda tarqalgan asalarisimonlarning namunalar soniga asosan 9 balli sistemada o‘rganildi. I) ball “juda kam turlar(yagona)” 1- 2 namunalar, II) ball “noyob (har doim ham emas)” 3 - 6 dona, III) ball “kam” 7 -14 nusxa, IV) ball “odatiy” 15 - 36 nusxa, V) ball “ko‘p uchraydigan” 37-89 nusxa, VI) ball 90-219 nusxa, VII) ball 220 - 538 nusxa, VIII) ball 539 - 1323 nusxa, IX) ball 1324 nusxadan ortiq.

Morfologik tahlil jarayonida ikkilangan turlarni molekulyar-genetik usulda aniqlash uchun PZR amplifikatsiyasida universal praymerlar, ya’ni LCO 1490 va HCO 2198 to‘g‘ri va teskari praymerlari qo‘llanildi.

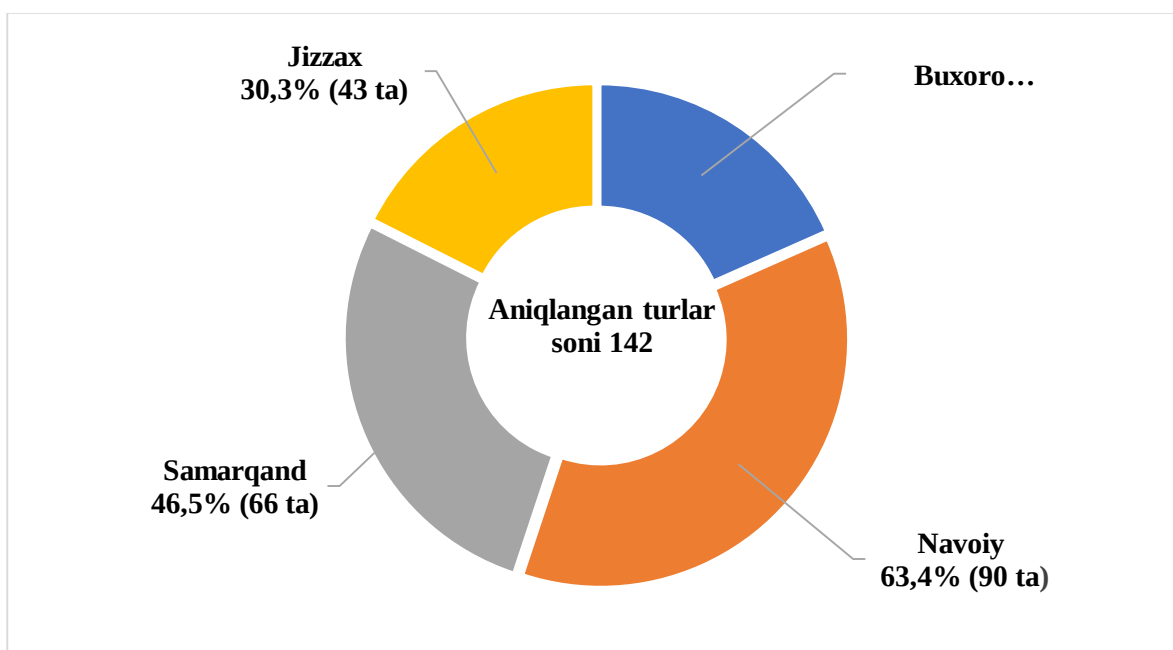
Dissertatsiyaning **“Markaziy O‘zbekiston asalarisimonlarning (Hymenoptera: Apoidea) tur tarkibi va taksonomik strukturasi”** deb nomlangan uchinchi bobi 3 bo‘limdan iborat bo‘lib, unda Markaziy O‘zbekiston asalarisimonlari faunasi bo‘yicha olib borilgan tadqiqot natijasida yig‘ilgan har bir turning aniqlangan joyi, tarqalishi, turlar soni, taksonomik o‘rni to‘g‘risida ma’lumotlar keltirilgan. 2022-2024 - yillar davomida Markaziy O‘zbekistonning turli biotoplarida olib borilgan tadqiqotlar natijasida asalarisimonlarning 142 turi aniqlanib, ulardan 21 turi: *Sceliphron madraspatanum* (Fabricius, 1781), *Palmodes orientalis* (Mocsáry, 1883), *Prionyx nudatus* (Kohl, 1885), *Prionyx melanotus* (F.Morawitz, 1890), *Eremochares dives* (Brullé, 1833), *Podalonia affinis* (W.Kirby, 1798), *Podalonia tydei* (Le Guillou, 1841), *Diodontus hyalipennis* (Kohl, 1892), *Astata boops* (Schränk, 1781), *Larra anathema* (Rossi, 1790), *Tachysphex costae* Kohl, 1892, *Bembix transcaspica* Radoszkowski, 1893, *Phlanthus variegatus* Spinola, 1838, *Lasioglossum niveocinctum* (Bluthgen, 1923), *Lithurgus chrysurus* Fonscolombe, 1834, *Xylocopa valga* Gerstäcker, 1872, *Nomada lathburiana* (Kirby, 1802), *Amegilla quadrifasciata* (de Villers, 1789), *Anthophora bimaculata* (Panzer, 1798), *Bombus terrestris* (Linnaeus, 1758), *Bombus campestris* (Panzer, 1801) Markaziy O‘zbekiston faunasi uchun ilk bor qayd etilib, ulardan bittasi *Prionyx melanotus* (F.Morawitz, 1890) O‘zbekiston faunasi uchun ham yangi tur sifatida qayd qilindi.

Yig‘ilgan 142 ta asalarisimonlarning 8 oila, 21 kenja oila, 52 avlodga mansubligi aniqlangan.



2 - rasm. Markaziy O‘zbekiston asalarisimonlarning oilalar bo‘yicha taqsimlanishi

Asalarisimonlarning oilalar bo‘yicha taqsimlanishiga e‘tibor berilsa Apidae (33 ta) va Crabronidae (32 ta) oilalari vakillari mos ravishda faunaning 23 % va 22 % ni egallab, yetakchilik qiladi. Turlar xilma- xilligiga muvofiq avlodlarning soni ham Apidae (6 ta avlod), Crabronidae (6 ta avlod) va shu bilan birgalikda Megachilidae (7 ta avlod) oilasi vakillari soni ham yuqori hisoblanadi (2-rasmga qarash). Faunadagi kam ulushni esa Andrenidae (4 ta) va Ampulicidae (1 ta) 3% va 1 % ni tashkil qiladi. Bunga sabab qilib esa Markaziy O‘zbekiston hududining aksariyat qismi cho‘l biotopini tashkil qiladi va u yerda asosan, Crabronidae oilasi va Apidae oilasi vakillari uchrashi ko‘rsatiladi.



3-rasm. Asalarisimonlarning Markaziy O‘zbekiston viloyatlari kesimida taqsimlanishi

Olingan ma'lumotlarga ko'ra, asalarisimonlar Markaziy O'zbekiston viloyatlar kesimida Jizzax viloyatida 43 tur, Samarqandda 66 tur, Buxoroda 46 tur va Navoiy viloyatida 90 ta tur ushbu katta oila hasharotlari turlari tarqalganligi birinchi bor aniqlandi (3-rasmga qarang).

3-jadval

Asalarisimonlarning faqat bitta viloyat uchun xos turlari

№	Viloyatlar	Turlar
1	Buxoro (11 ta tur)	<i>Palarus variegatus</i> , <i>Cerceris deserticola</i> , <i>Colletes bidentulus</i> , <i>Rophites quinquespinosus</i> , <i>Pseudapis elegantissima</i> , <i>Heriades truncorum</i> , <i>Coelioxys brevis</i> , <i>Megachile desertorum</i> , <i>Megachile parietina</i> , <i>Nomada lathburiana</i> , <i>Melecta luctuosa</i>
2	Navoiy (43 ta tur)	<i>Dolichurus turanicus</i> , <i>Chalybion turanicum</i> , <i>Podalonia ebenina</i> , <i>Podalonia tydei</i> , <i>Diodontus hyalipennis</i> , <i>Prosopigastra falsa</i> , <i>Oxybelus lamellatus</i> , <i>Oxybelus kizilkumii</i> , <i>Oxybelus latro</i> , <i>Bembix portschinskii</i> , <i>Bembix transcaspica</i> , <i>Stizus bizonatus</i> , <i>Stizus handlirschi</i> , <i>Philanthus variegatus</i> , <i>Colletes schwarzi</i> , <i>Hylaeus brevicornis</i> , <i>Andrena labialis</i> , <i>Andrena ovatula</i> , <i>Camptopoeum sp.</i> , <i>Lasioglossum annulipes</i> , <i>Lasioglossum matianense</i> , <i>Nomia rufescens</i> , <i>Lithurgus chrysurus</i> , <i>Osmia caerulescens</i> , <i>Osmia brevicornis</i> , <i>Osmia cephalotes</i> , <i>Coelioxys emarginatus</i> , <i>Coelioxys rufescens</i> , <i>Coelioxys aurolimbatus</i> , <i>Megachile apicalis</i> , <i>Epeolus laticauda</i> , <i>Eucera nigrilabris</i> , <i>Eucera clypeata</i> , <i>Tetralonia malvae</i> , <i>Amegilla quadrifasciata</i> , <i>Amegilla nigricornis</i> , <i>Amegilla magnilabris</i> , <i>Amegilla delicota</i> , <i>Anthophora atricilla</i> , <i>Anthophora fedtschenkoi</i> , <i>Melecta duodecimmaculata</i> , <i>Melecta festiva</i> , <i>Thyreus affinis</i>
3	Samarqand (21 ta tur)	<i>Anthophora affinis</i> , <i>Anthophora agama</i> , <i>Anthophora Tachysphex fulvitaris</i> , <i>Cerceris rybyensis</i> , <i>Colletes eous</i> , <i>Colletes hylaeiformis</i> , <i>Colletes wollmanni</i> , <i>Halictus albitarsis</i> , <i>Halictus annulipes</i> , <i>Halictus aprilius</i> , <i>Halictus desertorum</i> , <i>Halictus equestris</i> , <i>Halictus funiratus</i> , <i>Lasioglossum niveocinctum</i> , <i>Nomioides parviceps</i> , <i>Nomioides turanica</i> , <i>Nomada lathburiana</i> , <i>Nomada stigma</i> , <i>Eucera alborufa</i> , <i>Anthophora bimaculatevernalis</i>
4	Jizzax (8 ta tur)	<i>Pemphredon lethifer</i> , <i>Colletes floralis</i> , <i>Andrena bimaculate</i> , <i>Xylocopa valga</i> , <i>Nomada basalis</i> , <i>Nomada ruficornis</i> , <i>Anthophora deserticola</i> , <i>Anthophora fulvitaris</i>

Bu turlardan 19 tur barcha viloyatlarda tarqalgan bo'lsa, faqatgina Buxoro viloyati uchun 11 ta, Navoiy viloyati uchun 43 ta, Samarqand viloyati uchun 21 ta va Jizzax viloyati uchun esa 8 ta tur xosligi aniqlandi (3-jadvalga qarang).

Yig'ilgan namunalardan Jakkard koeffitsienti asosida asalarisimonlarning Markaziy O'zbekiston hududlari bo'yicha o'xshashliklari aniqlandi (4-jadvalga qarang).

4-jadval

Markaziy O'zbekiston viloyatlari asalarisimonlarining tur tarkibining o'zaro o'xshashlik koeffitsiyentlari (P. Jakkar koeffitsiyenti bo'yicha)

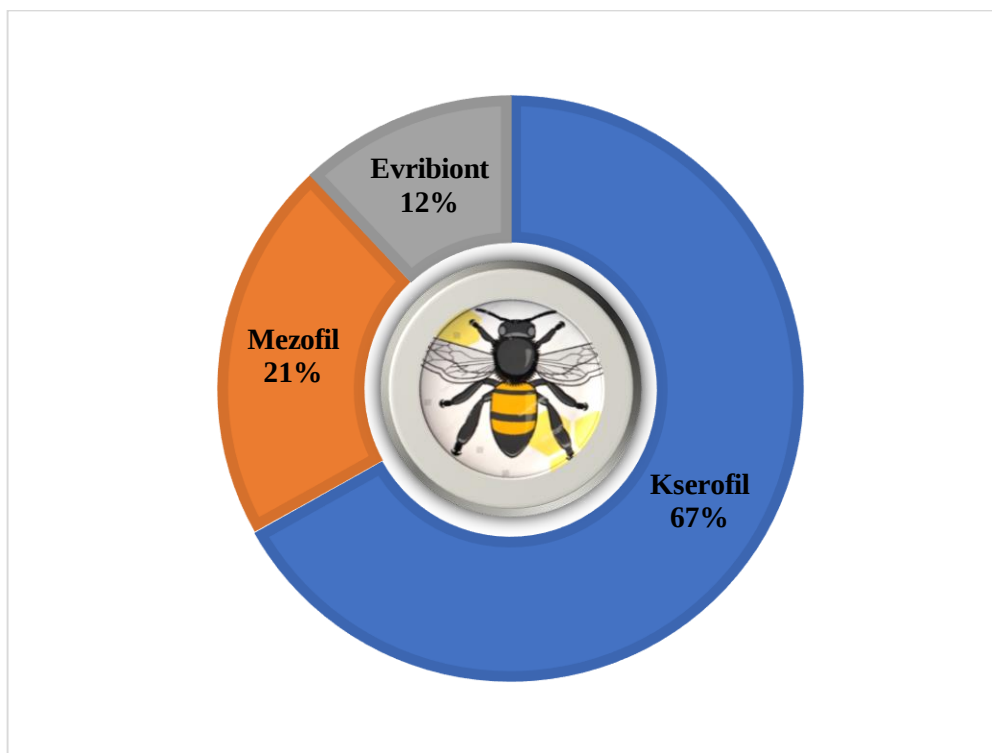
	Buxoro viloyati	Samarqand viloyati	Navoiy viloyati	Jizzax viloyati
Buxoro viloyati	1	-	-	-
Samarqand viloyati	0,258	1	-	-
Navoiy viloyati	0,308	0,268	1	-
Jizzax viloyati	0,309	0,434	0,209	1

Bu jadvalda asalarisimonlarining Markaziy O'zbekiston viloyatlarida tarqalishi bo'yicha Jizzax va Samarqand viloyatlari tur tarkibida o'xshashlik yaqin ekanligi kuzatildi. Bu viloyatlarning bir-biriga ancha yaqin iqlim sharoitlari va ular orasida geografik to'siqlarning kamligi bilan izohlanishi mumkin. Eng kam o'xshashlik esa Navoiy va Jizzax viloyatlari tur tarkibida kuzatildi. Bularda esa aksincha, nisbatan farqlanuvchi iqlim sharoitlari va bir necha geografik to'siqlar (tog' tizmalari, ko'l) mavjudligi sabab bo'lgan deyish mumkin.

Stizus Latreille, 1802 avlodi turlari bo'yicha o'tkazilgan molekulyar-genetik tadqiqotlar natijasi (sikvens xromatografiyasi) asosida *S. handlirschi* va *S. annulatus* turlarining mDNKsi COI sohasidan uzunligi 450 juft asosga ega bo'lgan nukleotidlar ajratib olindi hamda ushbu turlarni solishtirib o'rganish uchun xalqaro bioinformatik axborotlar markazidan genbank bazasidan (<https://ncbi.nlm.nih.gov>) SUB14399272 *Stizus handlirschi* (kirish raqami: PP726882) turidan foydalanildi.

Bioinformatik tahlil natijalariga ko'ra, *S. annulatus* turi genbank bazasidan olingan *S. handlirschi* (kirish raqami: PP726882) turining nukleotidlari o'rtasida 12 ta nukleotidlarda farqlanishlar borligi aniqlandi *S.handlirschi* turini mitoxondrial DNK sini COI sohasi xalqaro bioinformatik genlar bazasiga birinchi bor joylashtirildi.

Dissertatsiyaning **“Markaziy O'zbekiston asalarisimonlarning (Hymenoptera: Apoidea) ekologiyasi”** deb nomlangan to'rtinchi bobi uch bo'limni o'z ichga olib, unda asalarisimonlarning ekologik guruhlarini va Markaziy O'zbekiston hududi biotoplarida tarqalishini o'rganishga oid tadqiqotlarimiz natijalari keltirilgan. Olib borgan tadqiqotlarimiz natijalari asosida tadqiqot hududida aniqlangan 142 tur asalarisimonlar kserofil, mezofil, evribiont guruhlarga ajratilgan (4-rasmga qarang).



4-rasm. Asalarisimonlarning ekologik guruhlarga taqsimlanishi

Markaziy O‘zbekiston asalarisimonlari yashash joyining namlik darajasiga ko‘ra quyidagi ekologik guruhlarga bo‘linadi:

Kserofil – ushbu turlar ochiq va qurg‘oqchil joylarda yashashga moslashgan arilar, bular asosan qumli va cho‘l tuproqlarda, shuningdek quruq dasht va cho‘l hududlarda uchraydi. Bizning tadqiqotimiz natijasida olingan turlarning 90 tasi ya’ni 66,9%ni kserofillar tashkil qildi. Bunda Ampulicidae oilasi oilasidan 1 tur, Sphecidae oilasi 11tur, Crabronidae oilasi 16 tur, Colletidae oilasi 7 tur, Andrenidae oilasi 2 tur, Halictidae oilasi 16 tur, Megachilidae oilasi 19 tur, Apidae oilasi 23 turdan iborat.

Mezofillar – ochiq joylarda, shuningdek, soya joylarda ham yashovchi, namlanish darajasi mo‘tadil bo‘lgan yashash joylarining aholisidir. Bizning tadqiqotimiz natijasida olingan turlarning 30 tasi ya’ni 21,1%ni mezofillar tashkil qildi. Bunda Sphecidae oilasi 2 tur, Crabronidae oilasi 8 tur, Colletidae oilasi 2 tur, Andrenidae oilasi 1 tur, Halictidae oilasi 8 tur, Apidae oilasi 9 turdan iborat.

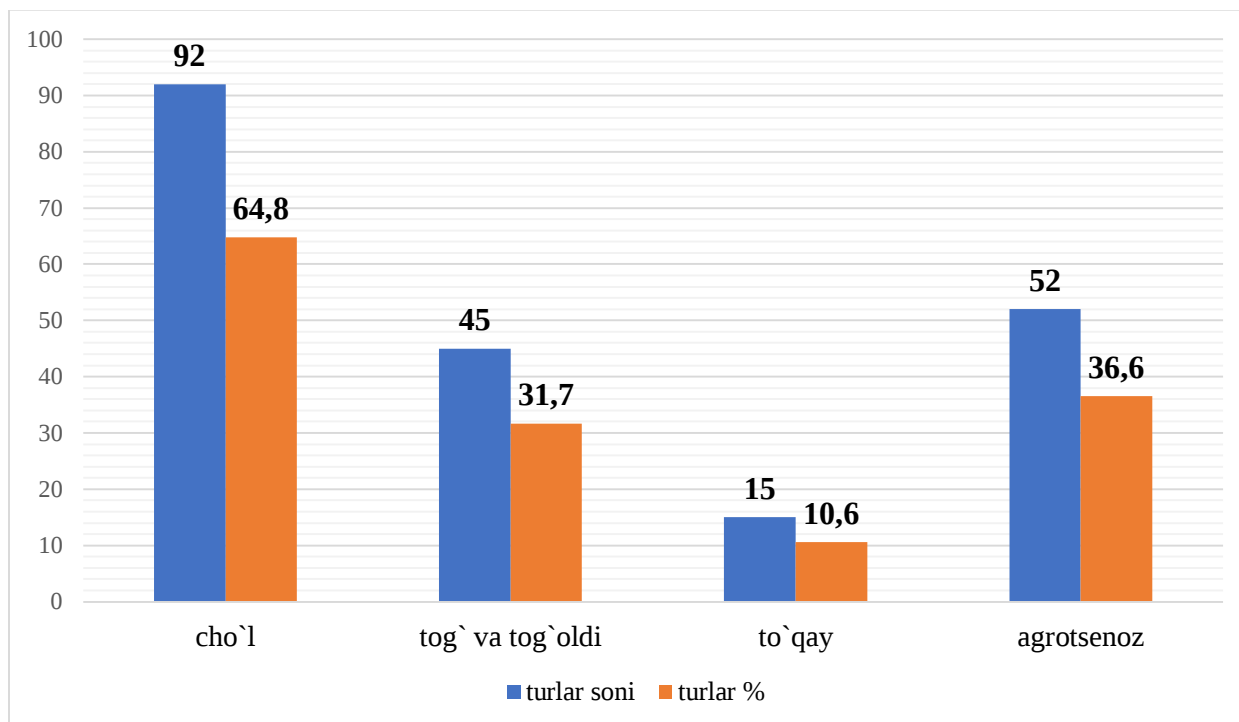
Evribiont – bu turlar deyarli barcha joylarda yashaydi. Bizning tadqiqotimiz natijasida olingan turlarning 17 tasi ya’ni 12 % ni mezofillar tashkil qildi. Bunda Sphecidae oilasi 8 tur, Crabronidae oilasi 8 tur, Apidae oilasi 1 turdan iborat (5-jadvalga qarang).

Tadqiqot o‘tkazilgan Markaziy O‘zbekiston hududlari tabiiy va antropogen landshaftlarga ajratildi. Shunga asosan, bu hududlarda tarqalgan asalarisimonlarning tur tarkibini 4 landshaft (cho‘l; tog‘ va tog‘oldi; to‘qay; agrotsenoz) kesimida tahlil qildik.

Asalarisimonlar ekologik guruhlarining oilalar kesimida taqsimlanishi

Oilalar	Kserofil	Mezofil	Evribiont
Ampulicidae (1 tur)	1 (100%)	-	-
Sphecidae (21 tur)	11 (52,3%)	2 (9,5%)	8 (38,1%)
Crabronidae (32 tur)	16 (50%)	8 (25%)	8 (25%)
Colletidae (9 tur)	7 (77,8%)	2 (22,2%)	-
Andrenidae (3 tur)	2 (66,7%)	1 (33,3%)	-
Halictidae (24 ur)	16 (66,7%)	8 (33,3%)	-
Megachilidae (19 tur)	19 (100%)	-	-
Apidae (33 tur)	23 (69,7%)	9 (27,3%)	1 (3%)
Jami: 142 tur	95 (66,9%)	30 (21,1%)	17 (12 %)

Markaziy O‘zbekiston asalarisimonlarining 64,8% (92 tasi) cho‘l hududida, 10,6% (15 tasi) esa to‘qay hududida aniqlangan (5-rasmga qarang). Bu natija asalarisimonlarning cho‘l hududiga moslashganligini ko‘rsatadi. Cho‘l hududida iqlim va o‘simliklar resurslari asalarisimonlarning hayoti uchun qulayroq bo‘lsa, to‘qay hududidagi ekologik sharoitlar asalarilarning ko‘payishiga kamroq imkoniyat yaratadi.

**5-rasm. Markaziy O‘zbekiston hududi landshaftlari**

Markaziy O‘zbekiston asalarisimonlarining turlar xilma- xilligi darajasini baholash va uni saqlash strategiyasini aniqlash uchun ushbu mintaqaning turli hududlarida o‘tkazilgan miqdoriy ro‘yxatga olish natijalarini ko‘rib chiqamiz. Hammasi bo‘lib 130 marta hisobga olindi va 142 turdagi 4274 ta namunalar yig‘ildi (6-jadvalga qarang).

6 - jadval

Markaziy O‘zbekiston asalarisimonlarining turlar xilma - xilligi darajasining baholash mezonlari

Ballik shkalasi	Namunalar soni	jami
I-Ball (juda kam yagona)	1-2 nusxa	16
II- Ball (noyob har doim ham emas)	3-6 nusxa	37
III- Ball (Kam nusxa)	7-14 nusxa	49
IV- Ball (Odatiy)	15-36 nusxa	10
V- Ball (ko‘p uchraydigan)	37-89 nusxa	17
VI- Ball	90-219 nusxa	7
VII- Ball	220-538 nusxa	4
VIII- Ball	539-1323 nusxa	1
IX- Ball	1324-dan ortiq	1
Jami:	4274	142

Jadval ma’lumotlaridan ko‘rinib turganidek, turlar soni $S = 142$ ta, yig‘ilgan umumiy namunalar soni $N = 4274$ ta Sturgess formulasi bo‘yicha hisoblangan, $k = 9$ ballar soni uchun quyidagi o‘lchov shkalasi hosil bo‘ldi: I) ball “juda kam turlar (yagona)” 1- 2 namunalar, II) ball “noyob (har doim ham emas)” 3 - 6 dona, III) ball “kam” 7 - 14 nusxa, IV) ball “odatiy” 15 - 36 nusxa, V) ball “ko‘p uchraydigan” 37- 89 nusxa, VI) ball 90- 219 nusxa, VII) ball 220- 538 nusxa, VIII) ball 539 - 1323 nusxa, IX) ball 1324 nusxadan ortiq. Shunday qilib, Sturgess formulasi asosida 9 ballik boylik shkalasi tanlangan bo‘lsa - da, biz turlarning boylik nuqtasi 9 balli miqdorini tashkil qildi. Bu turlar ishida sturgers shkalasining eng katta 9 ballini 1324 tadan *Apis mellifera* turidan ortiq namunalarni uchratmadik.

Yig‘ilgan va aniqlangan turlar har xil nisbatdagi boylikga ega bo‘lib, quyidagicha taqsimlanadi: juda kam turlar 16 ta, noyob turlar 37 ta, kam turlar 49 ta, odatiy turlar 10 ta, ko‘p uchraydigan turlar 17 ta tur, juda ko‘p uchragan tur 7 ta ni tashkil qildi. Bundan ko‘rinib turibdiki, turlarning boyligi jihatidan III - shkala bo‘yicha tarqalgan turlar ko‘pchilikni tashkil qiladi. Bu model aynan turlarning xilma-xilligini o‘rganishning haqiqiy asosi sifatida ko‘plab tadqiqotchilar tomonidan tavsiya etilgan. Markaziy O‘zbekiston asalarisimonlarining turlar xilma-

xilligi darajasining baholash mezonlari Yu.A.Pesenko (1982) usuli qabul qilindi va Sturgers shkalasi turlarning ko‘pligi modellarini ishlab chiqish uchun asos bo‘lib xizmat qiladi.

Dissertatsiyaning **“Asalarisimonlarning (Hymenoptera: Apoidea) zoogeografik tarqalishi va amaliy ahamiyati”** deb nomlangan beshinchi bobi ikki bo‘limdan iborat va unda Markaziy O‘zbekiston asalarisimonlarining zoogeografiyasi va amaliy ahamiyati haqidagi natija va ma’lumotlar keltirilgan. O.L.Krijinovskiy, A.F.Emelyanov (1974) va Q.Sh.Nurg‘azi, N.M.Omirjanova (2014) larning nomenklaturasiga asoslanib, yashash joylariga qarab Markaziy O‘zbekiston hududidagi asalarisimonlarni 13 ta guruhga ajratildi (7-jadvalga qarang).

7-jadval

Markaziy O‘zbekiston asalarisimonlari zoogeografik viloyatlar bo‘yicha tarqalishi

Guruhlar	Tur soni	% da
Kosmopolit turlar	1	0,7
Palearktika-Efiopiya turlari	5	3,5
Palearktika-Efiopiya-Indo-malay turlari	7	4,7
Palearktika-Efiopiya-Indo-malay-Avstraliya turlari	1	0,7
Palearktika-Indo-malay turlari	11	7,7
Golarktik turlari	4	2,8
Transpalearktik turlari	26	19,7
Boreal palearktik turlari	8	5,6
Qadimgi O‘rta yer dengizi turlari	46	32,3
Turon turlari	7	4,9
Eron-Turon turlari	6	4,2
Saxora-gobiy turlari	17	11
Markaziy Osiyo endemik turlari	3	2,1
Jami:	142	100

O‘zbekistonning dunyo xaritasidagi geografik joylashishi Qadimgi O‘rta Yer dengizi mintaqasiga to‘g‘ri keladi. Shu sababli ham olib borgan tadqiqotlarimizda aniqlangan asalarisimonlar turlarining eng ko‘pi 46 turi (32,3%) ushbu hududlarda tarqalganini kuzatishimiz mumkin. Shuningdek, Transpalearktik turlar 26 ta

(19,7%), Saxora-gobiy turlar 17 ta (11%), Palearktika-Indo-malay turlar 11 ta (7,7%) dan tur to'g'ri kelishi kuzatilib yuqori foizlarni tashkil etgan bo'lsa, Markaziy Osiyo endemik turlar 3 ta (2,1%), Palearktika-Efiopiya-Indo-malay-Avstraliya turlar 1 ta (0,7%), Kosmopolit turlar 1 ta (0,7%) dan eng kam ulushni egallagan.

O'zbekistonning tabiiy iqlim sharoiti qishloq xo'jalik ekinlari hosildorligini oshirish, asalari oilalarini zamonaviy ilg'or texnologiyalar asosida boqib, asalarichilik mahsulotlari yetishtirishni ko'paytirish uchun qulay imkoniyatlarga ega. So'nggi yillarda sohada vujudga kelgan salbiy oqibatlar natijasida asalari oilalari soni kamayib ketdi, bu esa mavjud asalari zotlarining irsiy xususiyatlaridan to'la foydalanish imkoniyatlarini chegaralab qo'ydi, asalarilarning rivojlanish qobiliyati kechika boshladi, qishlovdan chiqishi og'irlashdi, iqlim sharoitimizga va turli kasalliklarga chidamliligi pasaydi.

Asalarichilikda kasalliklarni to'g'ri aniqlash va ularni vaqtida davolash, asalarilarning sog'lig'ini saqlash va yuqori sifatli asal olishda muhim rol o'ynaydi. Tadqiqotimiz davomida turli dorilar bilan ishlov berilgan uyalarning natijalarini ko'rsatib o'tamiz (8-jadvalga qarang).

8-jadval

Asalarilarning parazitlar kasalliklariga qarshi kimyoviy preparatlarning samaradorligi (2020-2024 yy.)

	Dorilash turi	Ishlatilgan dori	Yil	Jami uyalar soni	Zararlangan uyalar (davolash dan oldin)	Zararlanmagan uyalar (davolashdan keyin)	Samaradorlik (%)
1	Varroatozga qarshi	Amitraz	2020	50	30	45	90%
2	Nozematozga qarshi	Fumagillin	2020	50	20	44	88%
3	Varroatozga qarshi	Formik kislotalar	2021	60	35	55	92%
4	Akarapidozga qarshi	Timol	2021	60	15	50	83%
5	Nozematozga qarshi	Flumetrin	2022	75	45	65	87%
6	Varroatozga qarshi	Probiotiklar	2022	75	25	67	90%
7	Akarapidozga qarshi	Oksalat kislota	2023	90	40	80	89%
8	Varroatozga qarshi	Kumafos	2023	90	35	78	86%
9	Varroatozga qarshi	Oksalat + Formik kislota	2024	100	45	85	95%
10	Nozematozga qarshi	Fumagillin + probiotiklar	2024	100	24	90	90%

Ushbu jadval xulosalariga ko'ra, tadqiqotimiz davomida Oksalat va Formik kislotalarning kombinatsiyasi – eng yuqori (95%) samaradorlikni ko'rsatdi. Fumagillin va probiotiklar aralash qo'llanganda nosematozga qarshi ta'sir juda yuqori (90%) bo'ldi. Amitraz, Flumetrin, va Kumafos kabi sintetik dorilar samarali bo'lsa ham, ularning uzoq muddatda qarshilik (rezistentlik) rivojlanish ehtimoli bor. Formik kislota va Oksalat kislota tabiiy vositalar bo'lib, ular kimyoviy qoldiq qoldirmagan holda samarali natijalar bergan.

XULOSALAR

“Markaziy O'zbekiston asalarisimonlari (Hymenoptera: Apoidea) faunasi, ekologik xususiyatlari va ahamiyati” mavzusidagi falsafa fanlari doktori (PhD) dissertatsiyasi bo'yicha olib borilgan tadqiqotlar asosida quyidagi xulosalar taqdim etildi.

1. Ilk bor Markaziy O'zbekiston hududida taksonomiyasi to'la tahlil qilinib, bugungi kunda hududda 8 ta oilalarning 21 kenja oila, 52 avlodga mansub 142 ta tur tarkibi aniqlandi.

2. Asalarisimonlarning oilalar taqsimlanish tahliliga e'tibor berilganda umumiy 8 ta oilaning qariyb 50% ga yaqinini Apidae va Crabronidae oilasiga mansubligi qayd etildi. Faunadagi kam ulushni esa Andrenidae (4 ta tur) 3% va Ampulicidae (1 ta tur) 1 % ni tashkil qiladi.

3. Aniqlangan turlardan asalarisimonlarning 21 ta turi Markaziy O'zbekiston uchun, O'zbekiston faunasi uchun Sphecidae oilasiga mansub *Prionyx melanotus* turi ilk bor qayd qilindi

4. Asalarisimonlar Markaziy O'zbekiston viloyatlar kesimida Jizzax viloyatida 43 tur, Samarqandda 66 tur, Buxoroda 46 tur va Navoiy viloyatida 90 ta tur ushbu katta oila hasharotlari turlari tarqalganligi kuzatildi.

5. Markaziy O'zbekiston asalarisimonlarining asosiy qismi 92 tasi (64,8%) cho'l hududida, eng kam qismi esa 15 tasi (10,6%) to'qay hududida aniqlangan.

6. O'zbekistonning geografik joylashuvi qadimgi O'rta Yer dengizi mintaqasiga to'g'ri keladi, shu sababli asalarisimonlar turlarining 33% (47 turi) ushbu hududlarda tarqalgan. Transpalearktik turlar 19,7% (26 turi), saxora-gobiy turlar 11% (17 turi), palearktika-indo-malay turlar 7,7% (11 turi) tashkil etadi. Markaziy Osiyo endemik turlari 1,4% (2 turi), palearktika-efiopiya-indo-malay-avstraliya turlari 0,7% (1 turi) va kosmopolit turlar 0,7% (1 turi) eng kam ulushni egallaydi.

7. Nozematoz va varroatoz kasalliklari asalarilarning salomatligiga jiddiy ta'sir ko'rsatib, ular asalarichilikda katta zarar keltirishi kuzatildi. Oksalat va Formik kislotalarining kombinatsiyasi 2024 - yilda Varroatozga qarshi amalga oshirilgan davolashda 95% samaradorlikni ko'rsatdi. Ushbu kombinatsiya asalarilarda varroatoz kasalligini davolashda yuqori samaradorlikni ta'minlab, kasallikni sezilarli darajada kamaytirishga erishildi. Oksalat va Formik kislotalarining birgalikdagi qo'llanilishi, asalarilarda parazitlarning ko'payishini keskin cheklashga

va ularning mahsuldorligini to'xtatib, umumiy salomatlikni yaxshilashda muhim rol o'ynadi.

**SCIENTIFIC COUNCIL DSc.02/30.12.2019.B.52.01 ON AWARD OF
SCIENTIFIC DEGREES AT THE ZOOLOGY INSTITUTE**

NATIONAL UNIVERSITY OF UZBEKISTAN

ELMURODOVA MUHAYYO VALIQUL QIZI

**FAUNA, ECOLOGY AND IMPORTANCE OF BEES OF CENTRAL
UZBEKISTAN**

03.00.06 – Zoology

**DISSERTATION ABSTRACT FOR THE DOCTOR OF PHILOSOPHY (PhD) ON
BIOLOGICAL SCIENCES**

Tashkent - 2025

The title of the doctoral dissertation (PhD) has been registered by the Supreme Attestation Commission at the Cabinet of Ministers of the Republic of Uzbekistan at the Ministry of Higher Education, Science and Innovation with registration numbers of B2022.2.PhD/B743

The dissertation has been carried out at the National university of Uzbekistan.

The abstract of the dissertation is posted in three languages (Uzbek, English, Russian (resume)) on the webpage of the Scientific Council (www.izoology.uz) and on the website of "ZiyoNET" information educational portal (www.ziyo.net).

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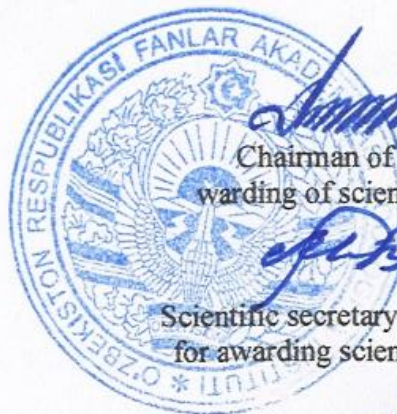
**National Pedagogical University of
Uzbekistan named after Nizami**

The defense of the dissertation will take place on «8» august in 2025 at 14⁰⁰ at the meeting of the Scientific council DSc.02/30.12.2019.B.52.01 in the Institute of zoology (Address: 232^b Bogishamol Str., Tashkent, 100053, Uzbekiston, Conference hall of the Institute of Zoology. Tel: (+99871) 289-04-65; E-mail: zoology@academy.uz).

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Abstract of the dissertation sent out on « 25 » july 2025.

(Protocol at the register № 8 dated « 25 » july 2025).



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INTRODUCTION (abstract of PhD thesis)

Relevance and necessity of the dissertation topic: In the world, the preservation of natural ecosystems and insect diversity is very relevant in the context of modern environmental problems. As a result of human activity, natural landscapes, plant and animal color change, in particular, insects are deprived of their habitat, which negatively affects the balance of the ecosystem. Insects are an important component of ecosystems on Earth and play an important role in processes such as pollination, food chains, and the decomposition of organic matter. Their diversity and abundance are necessary for ensuring the healthy work of nature. However, as a result of human agricultural activities, industrial facilities, and deforestation, insect habitats are decreasing, and many species are threatened. If we do not pay attention to these processes, the ability of nature to recover itself will decrease, and the difficulties in maintaining ecological balance will increase. Therefore, it is important to assess the current state of one of the important entomofauna groups in natural and anthropogenic ecosystems, analyze their faunal composition, study their distribution characteristics, ecology and zoogeography, as well as reveal their economic significance.

Scientific research is being conducted worldwide to assess the current state of one of the most important groups of insects, such as bees, analyze their faunal composition, spread, and study their economic significance and harmfulness. Every year, new species and subspecies are discovered, changes are made to the systematic state of many species, and special attention is paid to identifying the distribution areas of endangered and rare species and developing measures for their protection.

Our republic pays special attention to measures to identify insect biodiversity, protect them, and combat harmful species. Measures are being taken to ensure the sustainability of natural ecosystems and conserve rare and endangered species. Specifically, the Strategy for the Conservation of Biodiversity in the Republic of Uzbekistan for the period 2019-2028 outlines tasks for... “ensuring the conservation and sustainable use of biodiversity, developing and expanding protected natural areas, reducing the rate of degradation ²of natural ecosystems, and restoring rare and endangered species of animals and plants”. Based on these tasks, determining the species composition of bees organisms in the republic, analyzing their ecological characteristics, and studying their distribution is of great scientific significance. The development of practical measures to protect rare species and restore their habitats is also of great scientific and practical importance.

This dissertation research, to a certain extent, serves to fulfill the tasks outlined in the Decree of the President of the Republic of Uzbekistan № UP-60 of January 28, 2022, “On the Strategy for the Development of New Uzbekistan for 2022-2026”, the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan № 914 of November 7, 2018, “On State Accounting, Accounting for the Volumes of Use and State Cadastre of Objects of the Animal and Plant World”, the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan.

² Cabinet of Ministers of the Republic of Uzbekistan, Resolution No. 484 dated June 11, 2019: “On Approving the Strategy for the Conservation of Biological Diversity in the Republic of Uzbekistan for 2019–2028.”

Compliance of the research with the priority directions of the development of science and technology of the republic. This research was carried out in compliance with V the priority directions of the development of science and technology of the republic “Agriculture, biotechnology, ecology and environmental protection”.

Level of study of the problem: Scientific research on bees (Hymenoptera: Apoidea) was conducted by world scientists, including P.A. Latreille (1802), F.F. Kohl (1885-1901), A.V. Antropov (1994), M. Yurevich (2005), Yu.N. Danilov (2012-2020), P.G. Nemkov (2008-2017) and others. In the CIS countries, the fauna and ecology of bees species were studied by N.S. Borkhsenius (1962), V.V. Popov (1967), and V.L. Kazenas (1984), who provided an analysis of species that cause damage to agricultural crops. Scientific research on bees organisms in Central Asia, particularly in Uzbekistan, was conducted by A.V. Shestakov (1917), V.V. Gussakovsky (1927-1952) and Sh. Islamov (1971-1986). Their works are aimed at studying the species composition, bioecology, and ecological significance of bees organisms, and in recent years have been studied by specialists such as P.G. Nemkov (2016) and R. Murao (2017).

The connection of the research with the research plans of the higher educational institution where the dissertation was completed. The dissertation research was carried out within the framework of the research topic "Study and conservation of the biodiversity of the fauna of Uzbekistan" of the "Zoology" department of the National University of Uzbekistan (2021-2023 y.).

The purpose of the study: The aim of the research is to determine the fauna of bees in Central Uzbekistan, their modern species composition, determine their distribution areas, reveal their ecological characteristics, and economic significance.

Research tasks: Based on the above objectives, we aimed to perform the following tasks.

Determining the species composition and distribution of bee species in Central Uzbekistan.

Comparative analysis of the distribution of bees in the regions of Central Uzbekistan.

Analysis of the ecological characteristics of bees.

Determination of the distribution of bees by biotopes in the regions of Central Uzbekistan.

Analysis of the zoogeographic distribution of bees.

Determining the economic significance of bees

Research object: Species of the Central Uzbekistan bees (Hymenoptera: Apoidea).

The subject of research: the Taxonomic and faunistic analysis of bees species, their ecological characteristics, biotopic distribution in the territory of Central Uzbekistan, and economic significance.

Research methods: The dissertation employed zoological, entomological, ecological, molecular genetic, zoogeographic, and statistical methods.

The scientific novelties of the research are as follows:

For the first time, the species composition of Hymenoptera insects distributed in the natural and anthropogenic landscapes of Central Uzbekistan has been analyzed, revealing 142 species belonging to 8 families, 21 subfamilies, and 52 genera.

For the first time for the fauna of Uzbekistan, the species *Prionyx melanotus* of the family Sphecidae has been recorded, and in the territory of Central Uzbekistan, 21 species of bees belonging to 5 families and 18 genera have been identified.

The taxonomic position of one species (*Stizus handlirschi*) belonging to the main bee genus *Stizus* Latreille, 1802 in Central Uzbekistan has been confirmed through molecular-genetic analysis.

The distribution of bee species across four biotopes has been established, and the identified species have been subjected to zoogeographical analysis based on their distribution and habitats, resulting in their classification into 13 groups.

The practical results of the research are as follows:

Research conducted in the central regions of Uzbekistan, particularly in Navoi, Bukhara, Samarkand, and Jizzakh regions, is aimed at studying the fauna of bees. As a result of these studies, a list of bees species distributed in the area was compiled, and their biology, ecology, and distribution characteristics were studied.

One of the important achievements of the research is that these data were published in the international scientific publication “Catalog of Sphecidae”. This made it possible to use scientific data on the bees fauna of Central Uzbekistan on a global scale.

Research has created new opportunities for a deeper study of the ecological and biological characteristics of bees species, as well as ensuring their protection and ecological significance.

The reliability of the research results is based on the consistency of the experimental results obtained using zoological, herpetological methods and approaches used in the study with theoretical data, the use of morphometric data based on modern programs (Microsoft Office Excel, 2010; EXLSTAT 2010, Morpho J; ArgGIS); statistical analysis, publication of the results of the dissertation in foreign journals, and implementation of the developed recommendations into practice.

Scientific and practical significance of research results. The scientific significance of the research results is explained by a complete analysis of the bees fauna of Central Uzbekistan and an assessment of the current state of population distribution, the identification of new species, and the identification of their ecological features.

The practical significance of the research results is substantiated by the development of a database of bee species in the territory of Central Uzbekistan, the generalization of analytical information on their regional distribution, adaptation to ecological conditions, biological diversity, and economically important pollinator species, as well as the publication of research results on the distribution and bioecological characteristics of bee species in Central Uzbekistan in the “Catalog of Sphecidae”.

Implementation of research results. . Based on the scientific results obtained

on the taxonomy, ecological characteristics and distribution of bees (Apoidea) of Central Uzbekistan:

To enrich the fund of the zoological collection, 74 specimens of 74 bees species belonging to 8 families, 17 subfamilies, 40 genera of the Apoidea main family were included as collection materials in the "Collection of the Institute of Zoology" fund, which is the leading one in the Republic (Reference № 4/1255-2749 of the Academy of Sciences of the Republic of Uzbekistan dated December 11, 2024). As a result, the samples enriched the collection fund of insects and made it possible to use them for comparison, comparative analysis to determine the species composition, analysis of distribution by biotopes and atlas preparation.

Data on the nucleotide sequence of the mitochondrial DNA COI region of bees species of Central Uzbekistan are placed in the database of the National Biotechnology Information Center, Genbank (National Biotechnology Information Center, reference dated April 30, 2024, NCBI). As a result, the identification number PP726882 - *Stizus handlirschi* was obtained, which made it possible to substantiate the molecular taxonomic and phylogenetic position of this species.

Approval of research results. The results of this research were discussed at 4 international and 5 national scientific-practical conferences.

Publication of research results. A total of 16 scientific works were published on the topic of the dissertation, of which 7 articles were published in scientific publications recommended for publication of the main scientific results of doctoral dissertations of the Higher Attestation Commission of the Republic of Uzbekistan, including 3 in the republic and 4 in foreign scientific journals.

The structure and volume of the dissertation. The composition of the dissertation consists of an introduction, 5 chapters, conclusions, a list of references, and appendices. The volume of the dissertation is 120 pages.

THE MAIN CONTENT OF THE DISSERTATION

The introduction substantiates the relevance and necessity of the research topic, outlines the purpose and objectives of the study, and provides a description of the object and subject of the research. It also demonstrates the alignment of the study with the priority areas of development in science and technology of the Republic of Uzbekistan, highlights the degree of existing research on the issue, and presents the scientific novelty and practical results of the research. Furthermore, the scientific and practical significance of the obtained results is disclosed, along with information on the implementation of the research findings, published works, and the structure of the dissertation.

The first chapter of the dissertation, entitled "**The State of Research on Central Uzbekistan Apoidea (Hymenoptera: Apoidea)**", consists of two sections. It provides an overview of studies conducted on bee species (Apoidea) worldwide, within the Commonwealth of Independent States (CIS), and in Uzbekistan. This chapter addresses the current state of research on the topic, the historical development of the study of Apoidea species, their fauna, biology, zoogeography, and ecology. Detailed information is presented on the scientific research conducted

to date on the superfamily Apoidea. It is concluded that the existing materials are insufficient to draw comprehensive conclusions about the current state and ecological characteristics of Apoidea in Central Uzbekistan.

The second chapter of the dissertation “**Methods and materials for studying the fauna, ecological characteristics, and significance of bees (Hymenoptera: Apoidea) in Central Uzbekistan**” consists of two sections. This chapter presents an overview of the distribution of Apoidea species across the regions of Central Uzbekistan. During the course of the study, 14 research sites were selected from various locations throughout Central Uzbekistan.

GIS maps have been created to illustrate the distribution areas of Apoidea species in Central Uzbekistan. The coordinates of the regions were determined using the Maps.me application, and the maps were developed using ArgGIS Pro software. The resulting data were then entered into a database (see figure 1).

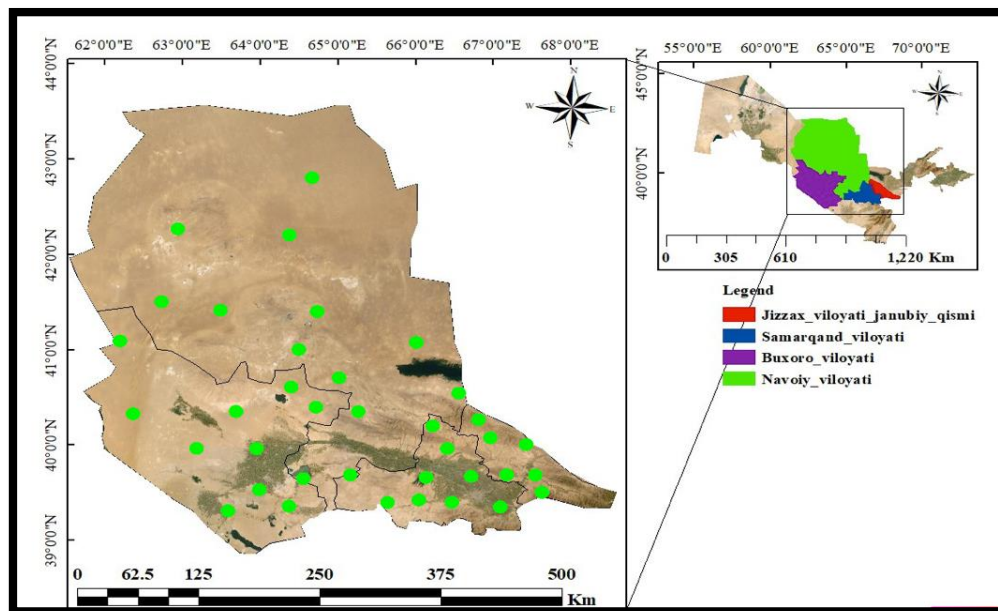


Figure 1. Map of Coordinates Collected for Apoidea Species in Central Uzbekistan

To determine the similarity in species composition of Apoidea across the provinces of Central Uzbekistan, the P. Jaccard index described in Chao's article was used.

$$K_j = \frac{c}{a + b - c}$$

Here, a and b represent the number of species found in each of the compared biocenoses, and c indicates the number of species common to both.

Based on Sturges's formula, the number of Apoidea specimens collected in Central Uzbekistan was analyzed using a 9-point scale as follows: I – very rare species (unique): 1-2 specimens; II – rare (not always present): 3-6 specimens; III – infrequent: 7-14 specimens; IV - common: 15–36 specimens; V - frequently encountered: 37-89 specimens; VI – 90-219 specimens; VII – 220-538 specimens; VIII – 539-1323 specimens; IX - more than 1324 specimens.

During the morphological analysis, to identify ambiguous species using molecular-genetic methods, universal primers specifically the forward and reverse primers LCO 1490 and HCO 2198 were used in PCR amplification.

The third chapter of the dissertation, entitled “**Species Composition and Taxonomic Structure of Apoidea (Hymenoptera: Apoidea) in Central Uzbekistan**”, consists of three sections. It provides information on each species collected during the research on the Apoidea fauna of Central Uzbekistan, including the location of identification, distribution, species count, and taxonomic position. As a result of field studies conducted in various biotopes of Central Uzbekistan from 2022 to 2024, a total of 142 Apoidea species were identified. Among them, 21 species—including *Sceliphron mdraspatanum* (Fabricius, 1781), *Palmodes orientalis* (Mocsáry, 1883), *Prionyx nudatus* (Kohl, 1885), *Prionyx melanotus* (F.Morawitz, 1890), *Eremochares dives* (Brullé, 1833), *Podalonia affinis* (W.Kirby, 1798), *Podalonia tydei* (Le Guillou, 1841), *Diodontus hyalipennis* (Kohl, 1892), *Astata boops* (Schrank, 1781), *Larra anathema* (Rossi, 1790), *Tachysphex costae*(Kohl, 1892), *Bembix transcaspica* (Radoszkowski, 1893), *Philanthus variegatus* (Spinola, 1838), *Lasioglossum niveocinctum* (Blüthgen, 1923), *Lithurgus chrysurus* (Fonscolombe, 1834), *Xylocopa valga* (Gerstäcker, 1872), *Nomada lathburiana* (Kirby, 1802), *Amegilla quadrifasciata* (de Villers, 1789), *Anthophora bimaculate* (Panzer, 1798), *Bombus terrestris* (Linnaeus, 1758), and *Bombus campestris* (Panzer, 1801) were recorded for the first time in the fauna of Central Uzbekistan. One of these species *Prionyx melanotus* (F. Morawitz, 1890), was also recorded as a new species for the fauna of Uzbekistan.

The 142 collected Apoidea species were identified as belonging to 8 families, 21 subfamilies, and 52 genera.

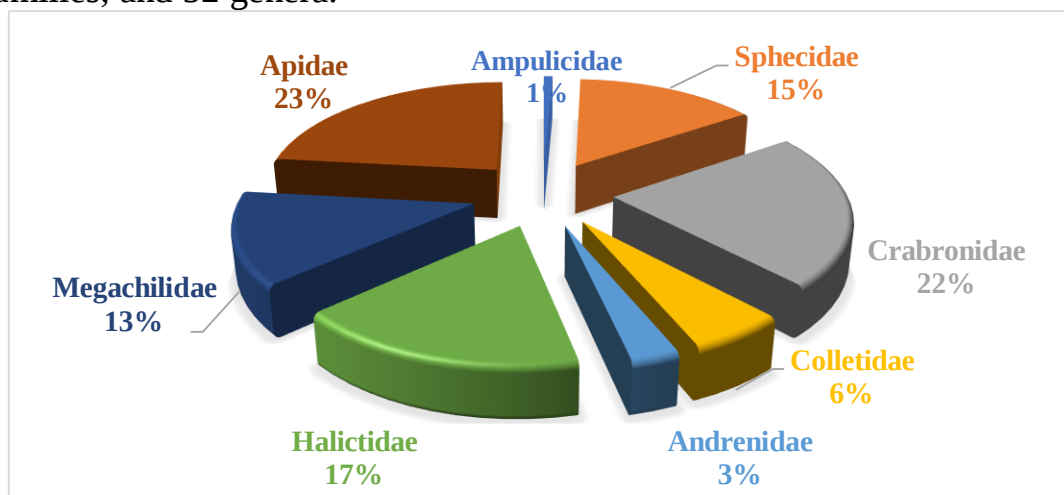


Figure 2. Distribution of Apoidea Species by Family in Central Uzbekistan

An analysis of the family-level distribution of Apoidea species shows that representatives of the families Apidae (33 species) and Crabronidae (32 species) are dominant, accounting for 23% and 22% of the fauna, respectively. Corresponding to the species diversity, the number of genera is also highest in Apidae (6 genera), Crabronidae (6 genera), and notably Megachilidae (7 genera) (see Figure 2). The families with the lowest representation in the fauna are Andrenidae (4 species) and

Ampulicidae (1 species), constituting only 3% and 1%, respectively. This is attributed to the fact that a significant portion of Central Uzbekistan consists of desert biotopes, where representatives of the families Crabronidae and Apidae are predominantly found.

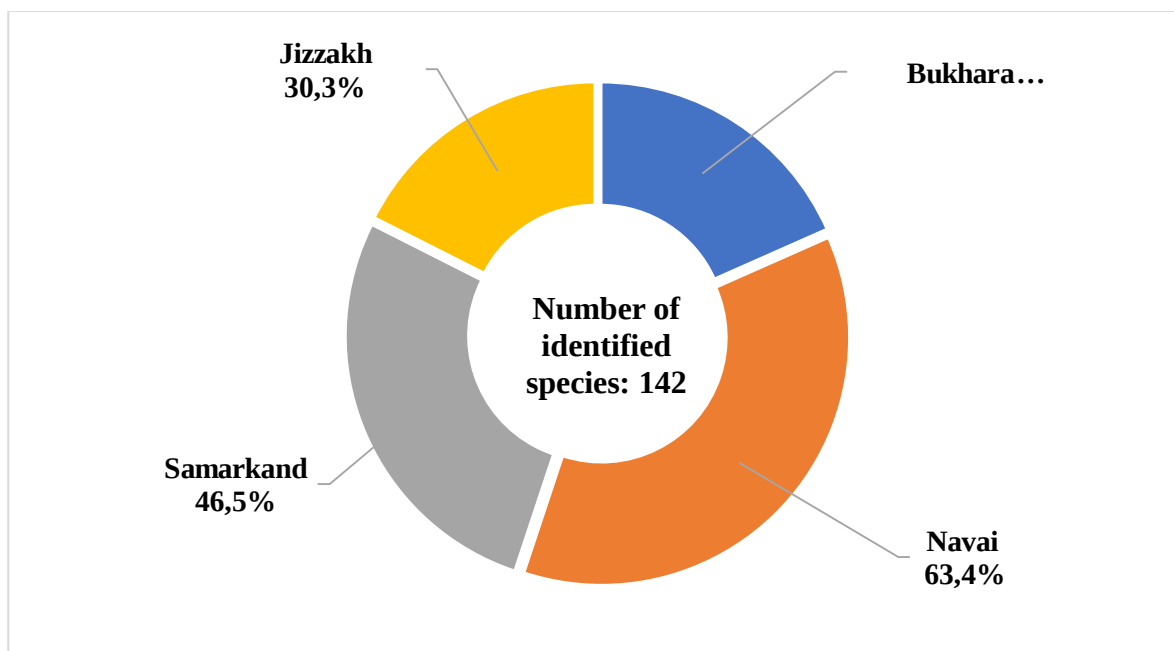


Figure 3. Distribution of Apoidea species across the provinces of Central Uzbekistan

According to the collected data, the distribution of Apoidea species across the regions of Central Uzbekistan was recorded for the first time as follows: 43 species in Jizzakh, 66 species in Samarkand, 46 species in Bukhara, and 90 species in Navoi (see figure 3).

Table 3

Species of Apoidea unique to a single regions

№	Regions	Species
1	Bukhara (11 species)	<i>Palarus variegatus</i> , <i>Cerceris deserticola</i> , <i>Colletes bidentulus</i> , <i>Rophites quinquespinosus</i> , <i>Pseudapis elegantissima</i> , <i>Heriades truncorum</i> , <i>Coelioxys brevis</i> , <i>Megachile desertorum</i> , <i>Megachile parietina</i> , <i>Nomada lathburiana</i> , <i>Melecta luctuosa</i>
2	Navoi (43 species)	<i>Dolichurus turanicus</i> , <i>Chalybion turanicum</i> , <i>Podalonia ebenina</i> , <i>Podalonia tydei</i> , <i>Diodontus hyalipennis</i> , <i>Prosopigastra falsa</i> , <i>Oxybelus lamellatus</i> , <i>Oxybelus kizilkumii</i> , <i>Oxybelus latro</i> , <i>Bembix portschinskii</i> , <i>Bembix transcaspica</i> , <i>Stizus bizonatus</i> , <i>Stizus handlirschi</i> , <i>Philanthus variegatus</i> , <i>Colletes schwarzi</i> , <i>Hylaeus brevicornis</i> , <i>Andrena labialis</i> , <i>Andrena ovatula</i> , <i>Camptopoeum sp.</i> , <i>Lasioglossum annulipes</i> , <i>Lasioglossum matianense</i> , <i>Nomia rufescens</i> , <i>Lithurgus chrysurus</i> , <i>Osmia caerulescens</i> , <i>Osmia brevicornis</i> , <i>Osmia cephalotes</i> ,

		<i>Coelioxys emarginatus</i> , <i>Coelioxys rufescens</i> , <i>Coelioxys aurolimbatus</i> , <i>Megachile apicalis</i> , <i>Epeolus laticauda</i> , <i>Eucera nigrilabris</i> , <i>Eucera clypeata</i> , <i>Tetralonia malvae</i> , <i>Amegilla quadrifasciata</i> , <i>Amegilla nigricornis</i> , <i>Amegilla magnilabris</i> , <i>Amegilla delicota</i> , <i>Anthophora atricilla</i> , <i>Anthophora fedtschenkoi</i> , <i>Melecta duodecimmaculata</i> , <i>Melecta festiva</i> , <i>Thyreus affinis</i>
3	Samarkand (21 species)	<i>Anthophora affinis</i> , <i>Anthophora agama</i> , <i>Anthophora Tachysphex fulvitaris</i> , <i>Cerceris rybyensis</i> , <i>Colletes eous</i> , <i>Colletes hylaeiformis</i> , <i>Colletes wollmanni</i> , <i>Halictus albitarsis</i> , <i>Halictus annulipes</i> , <i>Halictus aprilinus</i> , <i>Halictus desertorum</i> , <i>Halictus equestris</i> , <i>Halictus funiratus</i> , <i>Lasioglossum niveocinctum</i> , <i>Nomioides parviceps</i> , <i>Nomioides turanica</i> , <i>Nomada lathburiana</i> , <i>Nomada stigma</i> , <i>Eucera alborufa</i> , <i>Anthophora bimaculatevernalis</i>
4	Jizzakh (8 species)	<i>Pemphredon lethifer</i> , <i>Colletes floralis</i> , <i>Andrena bimaculate</i> , <i>Xylocopa valga</i> , <i>Nomada basalis</i> , <i>Nomada ruficornis</i> , <i>Anthophora deserticola</i> , <i>Anthophora fulvitaris</i>

Out of the collected species, 19 were found to be distributed across all provinces, while 11 species were unique to Bukhara, 43 to Navoi, 21 to Samarkand, and 8 to Jizzakh (see table 3). Based on the collected samples, the similarity of Apoidea species across the regions of Central Uzbekistan was determined using the Jaccard coefficient (see table 4).

Table 4

Similarity Coefficients of Apoidea Species Composition Among the Provinces of Central Uzbekistan (Based on P. Jaccard Coefficient)

	Bukhara	Samarkand	Navoi	Jizzakh
Bukhara	1	-	-	-
Samarkand	0,258	1	-	-
Navoi	0,308	0,268	1	-
Jizzakh	0,309	0,434	0,209	1

The table shows that among the provinces of Central Uzbekistan, the species composition of Apoidea in Jizzakh and Samarkand exhibits the highest similarity. This can be attributed to the relatively similar climatic conditions in these provinces and the minimal presence of geographical barriers between them. In contrast, the lowest similarity was observed between the species composition of Navoi and Jizzakh provinces, likely due to differing climatic conditions and the presence of several geographical barriers such as mountain ranges and lakes. Based on the results of molecular-genetic studies (sequencing chromatography) conducted on species of the genus *Stizus* Latreille, 1802, mitochondrial DNA (mtDNA) fragments of *S. handlirschi* and *S. annulatus* were isolated from the COI region, each with a

nucleotide length of 450 base pairs. For comparative analysis of these species, the GenBank database of the international bioinformatics data center (<https://ncbi.nlm.nih.gov>) was used, specifically the *Stizus handlirschi* sequence with accession number SUB14399272 (entry number: PP726882).

According to the results of bioinformatic analysis, it was determined that there are 12 nucleotide differences between the *S. annulatus* species and the *S. handlirschi* species (accession number: PP726882) obtained from the GenBank database. The mitochondrial DNA (COI region) of *S. handlirschi* was submitted to the international bioinformatics gene database for the first time.

The fourth chapter of the dissertation, titled “**Ecology of Apoidea (Hymenoptera: Apoidea) in Central Uzbekistan**”, consists of three sections and presents the results of our research on the ecological groups of Apoidea and their distribution in various biotopes of Central Uzbekistan. Based on the findings of our study, the 142 identified species of Apoidea in the research area were classified into xerophilous, mesophilous and eurybiotic species (see figure 4).

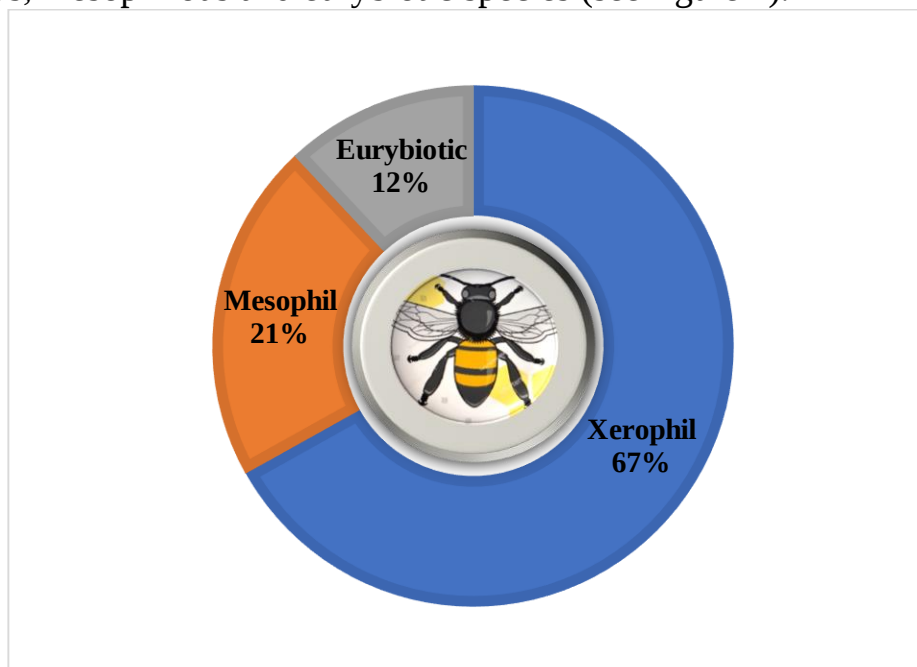


Figure 4. Distribution of Apoidea Species by Ecological Groups

According to the degree of habitat moisture, the bee species (Apoidea) of Central Uzbekistan are classified into the following ecological groups:

Xerophilic species – These are bees adapted to live in open and arid environments, predominantly found in sandy and desert soils, as well as in dry steppe and desert regions. Based on our research results, 90 species, accounting for 66,9% of the identified taxa, were classified as xerophilic. These included representatives from the following families: Ampulicidae – 1 species, Sphecidae – 11 species, Crabronidae – 16 species, Colletidae – 7 species, Andrenidae – 2 species, Halictidae – 16 species, Megachilidae – 19 species, Apidae – 23 species.

Mesophilic species – These bees inhabit open areas as well as shaded places with moderately moist conditions. Our study revealed that 30 species, or 21,1% of the total, belong to this ecological group. The distribution among families is as

follows: Sphecidae – 2 species, Crabronidae – 8 species, Colletidae – 2 species, Andrenidae – 1 species, Halictidae – 8 species, Apidae – 9 species.

Eurybiontic species – These species are capable of inhabiting a wide range of environmental conditions. According to our findings, 17 species (12 %) were classified as eurybionts. These include: Sphecidae – 8 species, Crabronidae – 8 species, Apidae – 1 species. (see table 5)

The regions of Central Uzbekistan where the research was conducted were categorized into natural and anthropogenic landscapes. Based on this, the species composition of bees in these regions was analyzed across four landscape types: desert, mountainous and foothill, riparian (tugai) and agrocnoses.

Table 5

Distribution of Ecological Groups of Apoidea by Taxonomic Families

Families	Xerophilic	Mesophilic	Eurybiontic
Ampulicidae (1 species)	1 (100%)	-	-
Sphecidae (21 species)	11 (52,3%)	2 (9,5%)	8 (38,1%)
Crabronidae (32 species)	16 (50%)	8 (25%)	8 (25%)
Colletidae (9 species)	7 (77,8%)	2 (22,2%)	-
Andrenidae (3 species)	2 (66,7%)	1 (33,3%)	-
Halictidae (24 species)	16 (66,7%)	8 (33,3%)	-
Megachilidae (19 species)	19 (100%)	-	-
Apidae (33 species)	23 (69,7%)	9 (27,3%)	1 (3%)
142 species	95 (66,9%)	30 (21,1%)	17 (12 %)

In Central Uzbekistan, 64,8% (92 species) of Apoidea were identified in desert areas, while 10,6% (15 species) were recorded in riparian (tugai) habitats (see Figure 5). These findings indicate that Apoidea are better adapted to desert environments. The climatic conditions and plant resources in desert regions are generally more favorable for the life cycle of Apoidea, whereas the ecological conditions in riparian habitats provide comparatively fewer opportunities for their reproduction.

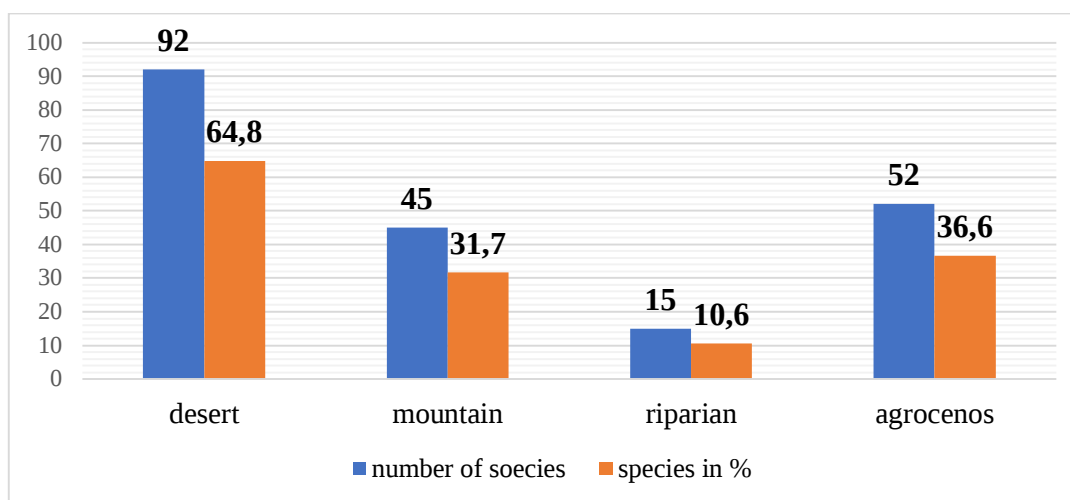


Figure 5. Landscapes of Central Uzbekistan

To assess the species diversity level of Hymenopterans in Central Uzbekistan and to determine a conservation strategy, we examine the results of quantitative surveys conducted in various regions of this area. In total, 130 sampling events were carried out, and 4274 specimens representing 142 species were collected (see Table 6).

Table 6

Criteria for Assessing the Level of Species Diversity of Hymenopterans in Central Uzbekistan

Point-based scale	Number of specimens collected	Total
I point – Very rare, unique	1–2 specimens	16
II- Point (rare, not always)	3-6 specimens	27
III- Point (few specimens)	7-14 specimens	49
IV- Point (common)	15-36 specimens	10
V- Point (frequently encountered)	37-89 specimens	16
VI- Point	90-219 specimens	10
VII- Point	220-538 specimens	10
VIII- Point	539-1323 specimens	2
IX- Point	more than 1324	2
Total:	4274	142

As can be seen from table data, the number of species is $S = 142$, the total number of specimens collected is calculated according to the Formula $N = 4274$ Sturges, for the number of points $k = 9$ the following scale was formed: I) score "very rare species (single)" 1 - 2 specimens, II) score "rare (not always)" 3 - 6 pieces, III) score "rare" 7 - 14 copies, IV) score "typical" 15 - 36 copies, V) score "frequent" 37 - 89 copies, VI) score 90 - 219 copies, VII) score 220 - 538 copies, VIII) score 539 - 1323 copies, IX) score over 1324 copies. Thus, although a wealth scale of 9 points was chosen based on the Sturges formula, we found that the wealth point of the species was 9 points. In this species work, the largest score of the Sturges scale was 9 out of 1324 specimens from *Apis mellifera*.

The collected and identified species have a wealth of varying proportions and are distributed as follows: very few species accounted for 16, rare species 37, rare species 49, common species 10, common species 17, very abundant species 7. It can be seen from this that in terms of species richness, species distributed on Scale III are the majority. This model has been recommended by many researchers precisely as the real basis for the study of species diversity. Criteria for assessing the level of species diversity of bees of Central Uzbekistan Yu.A. The Pesenko (1982) method was adopted and the Sturges scale serves as the basis for the development of species abundance models.

The fifth chapter of the dissertation, entitled "**Zoogeographical Distribution and Practical Importance of Apoidea (Hymenoptera)**", consists of two sections and presents findings and information regarding the zoogeography and practical significance of Apoidea in Central Uzbekistan. Based on the nomenclature of A.F. Emelyanov (1974) and Q.Sh. Nurg'azi and N.M. Omirjanova (2014), the Apoidea species of Central Uzbekistan were classified into 13 groups according to their habitats (see Table 7).

Table 7

Distribution of Apoidea of Central Uzbekistan by Zoogeographical Regions

Groups	Number of species	In %
Cosmopolitan species	1	0,7
Palearctic-Ethiopian species	5	3,5
Palearctic-Ethiopian-Indo-Malayan species	7	4,7
Palearctic-Ethiopian-Indo-Malayan-Australian species	1	0,7
Palearctic-Indo-Malayan species	11	7,7
Holarctic species	4	2,8
Trans-Palaearctic species	26	19,7
Boreal Palaearctic species	8	5,6
Ancient Mediterranean species	46	32,3
Turanian species	7	4,9
Iran-Turanian species	6	4,2
Sahara-Gobi species	17	11
Central Asian endemic species	3	2,1
Total	142	100

Uzbekistan's geographical location on the world map corresponds to the Ancient Mediterranean region. Therefore, our research revealed that the majority of hymenopteran species identified - 46 species (32,3%) are distributed in this area. Additionally, Trans-Palearctic species accounted for 26 species (19,7%), Sahara-Gobi species for 17 species (11%), and Palearctic-Indo-Malayan species for 11 species (7,7%), representing relatively high percentages. In contrast, Central Asian

endemic species (3 species, 2,1%), Palearctic-Ethiopian-Indo-Malayan-Australian species (1 species, 0,7%), and cosmopolitan species (1 species, 0,7%) comprised the smallest proportions.

Uzbekistan's natural and climatic conditions provide favorable opportunities for increasing agricultural crop yields, breeding honeybee colonies using modern advanced technologies, and expanding the production of beekeeping products. However, in recent years, due to adverse developments in the sector, the number of bee colonies has significantly decreased. This has limited the full utilization of the genetic traits of existing bee breeds, delayed their developmental potential, made overwintering more difficult, and reduced their resistance to local climatic conditions and various diseases.

Accurate diagnosis and timely treatment of diseases in beekeeping play a crucial role in maintaining bee health and obtaining high-quality honey. During our research, we present the results observed in hives treated with various medications (see Table 8).

Table 8

Effectiveness of Treatments Against Parasitic Diseases in Honey Bees (2020–2024)

	Type of Treatment	Administered Drug	Year	Total Number of Bee Colonies	Infected Colonies (Before Treatment)	Uninfected Colonies (After Treatment)	Efficiency (%)
1	Against varroatosis	Amitraz	2020	50	30	45	90%
2	Against nosematosis	Fumagillin	2020	50	20	44	88%
3	Against varroatosis	Formic acids	2021	60	35	55	92%
4	Against acarapidosis	Timol	2021	60	15	50	83%
5	Against nosematosis	Flumetrin	2022	75	45	65	87%
6	Against varroatosis	Probiotics	2022	75	25	67	90%
7	Against acarapidosis	Oxalic acid	2023	90	40	80	89%
8	Against varroatosis	Kumafos	2023	90	35	78	86%
9	Against varroatosis	Oxalic acid+ Formic acids	2024	100	45	85	95%
10	Against nosematosis	Fumagillin + probiotics	2024	100	24	90	90%

According to the conclusions drawn from this table, the combination of oxalic acid and formic acid demonstrated the highest efficacy during our research, reaching 95% effectiveness. The combined use of Fumagillin and probiotics also proved highly effective against nosema disease, achieving 90% efficacy. While synthetic drugs such as Amitraz, Flumethrin, and Coumaphos showed effectiveness, their long-term use carries a risk of resistance development. In contrast, formic acid and

oxalic acid are natural treatments that provided high efficacy without leaving chemical residues.

CONCLUSIONS

Based on the research conducted for the Doctor of Philosophy (PhD) dissertation titled **“Fauna, Ecological characteristics, and significance of Apoidea (Hymenoptera) in Central Uzbekistan,”** the following conclusions have been presented.

1. For the first time, a comprehensive taxonomic analysis was conducted in the Central Uzbekistan region, resulting in the identification of 142 species belonging to 8 families, 21 subfamilies, and 52 genera.

2. During the 2022–2024 research period, analysis of the family-level distribution of Apoidea in the region revealed that nearly 50% of the total eight families were represented by the Apidae and Crabronidae families. In contrast, the families Andrenidae 3 % (4 species) and Ampulicidae 1 % (1 species) constituted the smallest proportion of the fauna.

3. Based on the research findings obtained during the investigation process, 21 species of Apoidea were recorded as new for Central Uzbekistan, and one species belonging to the family Sphecidae (*Prionyx melanotus*) was identified and documented as a species new to the fauna of Uzbekistan.

4. In terms of regional distribution within Central Uzbekistan, it was determined that species of Apoidea are represented by 43 species in Jizzakh Region, 66 species in Samarkand, 46 species in Bukhara, and 90 species in Navoi Region.

5. The majority of Apoidea species in Central Uzbekistan 92 species (64,8%) were identified in desert regions, while the smallest portion 15 species (10,6%) were recorded in riparian (tugai) habitats.

6. Uzbekistan’s geographic location corresponds to the ancient Mediterranean region, which explains why 33% (47 species) of Apoidea species are distributed in this area. Trans-Palearctic species constitute 19,7% (26 species), Sahara-Gobi species 11% (17 species), and Palearctic-Indo-Malayan species 7,7% (11 species). Central Asian endemic species account for 1,4% (2 species), while Palearctic-Ethiopian-Indo-Malayan-Australian and cosmopolitan species each represent the lowest share at 0,7% (1 species).

7. Nosematosis and varroatosis have a significant impact on bee health, causing considerable damage to apiculture. The combination of oxalic and formic acids demonstrated 95% effectiveness in treating varroatosis in 2024. This combination provided high therapeutic efficacy, significantly reducing the prevalence of varroatosis among bees. The joint application of oxalic and formic acids played a crucial role in inhibiting parasite proliferation and improving the overall health of the bee colonies.

**НАУЧНЫЙ СОВЕТ DSc.02/30.12.2019.В.52.01 ПО ПРИСУЖДЕНИЮ
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НАЦИОНАЛЬНЫЙ УНИВЕРСИТЕТ УЗБЕКИСТАНА**

ЭЛМУРОВОДА МУХАЙЁ ВАЛИКУЛ КИЗИ

**ФАУНА, ЭКОЛОГИЯ И ЗНАЧЕНИЕ ПЧЕЛИНЫХ ЦЕНТРАЛЬНОГО
УЗБЕКИСТАНА**

03.00.06 – Зоология

**АВТОРЕФЕРАТ ДИССЕРТАЦИИ ДОКТОРА ФИЛОСОФИИ (PhD) ПО
БИОЛОГИЧЕСКИМ НАУКАМ**

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ВВЕДЕНИЕ (аннотация к диссертации доктора философии (PhD))

Цель исследования: определение фауны, современного видового состава, определение ареалов распространения, экологических особенностей и хозяйственного значения пчелообразных в Центральном Узбекистане

Объект исследования: Виды пчелиных (Hymenoptera: Apoidea) Центрального Узбекистана.

Научная новизна исследования заключается в следующем:

Впервые проведён анализ видового состава перепончатокрылых насекомых, распространённых в природных и антропогенных ландшафтах Центрального Узбекистана, в результате чего выявлено 142 вида, относящихся к 8 семействам, 21 подсемейству и 52 родам.

Впервые для фауны Узбекистана зарегистрирован вид *Prionyx melanotus* из семейства Sphecidae, а на территории Центрального Узбекистана идентифицирован 21 вид пчел, относящихся к 5 семействам и 18 родам.

Таксономическое положение одного вида (*Stizus handlirschi*), относящегося к основному пчелиному роду *Stizus* Latreille, 1802, подтверждено с помощью молекулярно-генетического анализа.

Установлено распространение видов пчел по четырём биотопам, и на основе их распространения и среды обитания проведён зоогеографический анализ выявленных видов, в результате которого они были классифицированы на 13 групп.

Внедрение результатов исследований. На основе полученных научных результатов по изучению таксономии, экологических особенностей и распространения пчелообразных (Apoidea) Центрального Узбекистана.

Для обогащения фонда коллекции зоологии 74 образца 74 видов пчелообразных, относящихся к 40 родам, 17 подсемействам, 8 семействам надсемейства Apoidea, включены в качестве коллекционных материалов в уникальный объект — ведущий в республике фонд «Коллекция Института зоологии» (Справка Академии наук Республики Узбекистан № 4/1255-2749 от 11 декабря 2024 года). В результате данные образцы не только обогатили фонд коллекции насекомых, но и предоставили возможность использовать их для сопоставления, сравнительного анализа с целью определения видового состава, а также для анализа распределения по биотопам и подготовки атласа.

Данные по нуклеотидной последовательности митохондриальной ДНК COI участка видов пчелообразных Центрального Узбекистана размещены в Национальном информационном центре биотехнологии, базе данных Генбанка (Национальный информационный центр биотехнологии, справка от 30 апреля 2024 года, NCBI). В результате был получен идентификационный номер PP726882 - *Stizus handlirschi*, что позволило обосновать молекулярно-таксономическое и филогенетическое место данного вида.

Структура и объем диссертации. В состав диссертации входят введение, 5 главы, выводы, список использованной литературы и приложения. Объем диссертации составляет 120 страниц.

E'LON QILINGAN ILMIY ISHLAR RO'YXATI
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