

[Description of a new species of *Cheilosia* from China and its life cycle]

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Abstract

The paper described a new species, *Cheilosia hebeiensis* sp.nov., from Hebei Province, China. The new species belonged to the *proxima* group. Based on the key of Vujic et al (2013), the new species was similar to *Cheilosia rufimana* Becker 1894 in appearance, but differs from the latter by the whitish long bristle-like hairs on the posterior margin of scutellum and the shape of the superior lobe of the male. The type specimens were deposited in Shaanxi University of Technology and Forestry and Grassland Pest Control and Quarantine Station, Hebei Mulan Paddock State Forest. A detailed description and figures of the new species were offered, and the life cycle of the species was also reported.

Introduction

The genus *Cheilosia* of the family Syrphidae is mainly distributed in the Palaearctic, Nearctic and Oriental regions, and also in the Neotropical and Australian regions. About 480 species are known in the world, of which the Palaearctic region accounts for about 70% [1-15]. Since Professor Sack's description of the species of the genus in China in 1927, many scholars have carried out research on the Chinese species, which has increased the number of species to about 105 [16-36].

Mulan Forest Farm of Hebei Province is located in Weichang Manchu and Mongolian Autonomous County of Hebei Province. It is located in the southern edge of the Hunshandake Sandy Land and the upper reaches of the Luan River 41°35'~42°40'N, 116°32'~117°14'E, and the altitude is 750~1998 m. This area belongs to the transition zone from semi-arid to semi-humid, from the cold temperate zone to the middle temperate zone. The lowest temperature is -42.9 °C, and the average annual precipitation is 380-560 mm, mainly concentrated in July-September. From 2018 to 2019, a systematic survey of forest insects in the forest farm area was carried out. In the North China larch forest, a black hoverfly was found in the larval stage in the North China larch gum. Through the observation and research of the larval morphology and life history of pupae and adults, it was identified as a new species. The type specimens of the new species are preserved in the Shaanxi University of Technology and the State-owned Forest Farm Forest and Grass Pest Control and Quarantine Station in Mulan Weichang, Hebei Province. The authors describe the new species and its related biological characteristics.

1. Description of *Cheilosia hebeiensis* sp.nov. [many bits hard to understand]

Male: compound eyes densely covered with light yellow hairs. The top of the head is raised, covered with dark brown long hair and white powder, and the ocellar triangle is equilateral. The forehead is slightly bulging, and the frontal angle is larger; the forehead is black, covered with white powder coat, covered with long white hairs and a small number of black hairs. The lunule is black, and the antennal fossa separated. Wide color [?] black, with white wool, small central prominence, more than the frontal process in side view, slightly more than front edge of mouth; eye margin is medium wide, the widest part is not more than half of the height of the third segment of the antenna, black, sometimes under the compound eyes it is dark brown, densely covered with white hairs and powder. Cheek high, black, covered with long white hairs and pink. The two segments at the base of the antennae are dark brown, the 3rd segment is nearly round, yellowish brown, and the hind margin is dark. The antennae are dark brown and the coat is very short.

The thorax is black, covered with white powder coat, covered with long white hairs of nearly the same length, the lateral edge of the thoracic back plate has no mane, the back edge of the small scutellum has white mane-like long hairs, the lower edge of the shield is white, long and dense; the side plate is powdery, the quilt [?] is the same backboard as the wool. The hind thorax is covered with long white hairs.

Legs black, end of each femur and base of tibia dark brown, covered with white powdery coat, covered with short white hairs, ventral and posterior sides of front and middle femora with long white hairs,

anterior side of hind femur with sparser hairs. The long white hairs are 3 to 4 times as long as the short hairs, and the front side of the tibia has dark brown bristle-like long hairs, the length of which is not longer than the diameter of the tibia. The front part of the wing is slightly yellow, with slight spines; the intersection of wing vein M1 and R4+5 forms an acute angle; the haltere bar is yellow, and the base and head are yellowish brown. The abdomen is nearly oblong, black, covered with long white hairs of the same length.

Male genitalia: dark brown. The ninth backboard is taller than long in side view. The tail is nearly quadrangular, light yellow, covered with dark brown mane-shaped long hairs of light yellow long hairs. The dorsal needles are triangular, the top is broad and blunt, and the middle part of the dorsal margin forms a clear ridge, with dark brown long bristles, and the inner surface of the end has dark brown short bristles. The ninth web is cylindrical, with a transparent area in the middle of the back of the ventral surface. The upper lobe is narrow and long, the base is almost rectangular, the end is twisted towards the center of the ventral surface, flattened front and back, and the apex is round. The end surface of the penis is forked in view from the back, with two ejaculatory process membranous between forks.

Females: significantly shorter coat than males. The compound eyes are covered with short hairs. The top of the head and the forehead are relatively wide, and the width of the top of the head is about 1/3 of the head width at the posterior edge of the compound eyes, with finely carved points, 3 longitudinal grooves, and horizontal grooves in the front; the top of the head and the forehead are black, and the two sides of the middle of the forehead are along the edge of the eyes. It has long and narrow yellow spots, covered with nearly white powder, and is mainly covered with black short hairs. The antennae are yellowish brown, the third segment is orange yellow, large and round. The back of the chest is mainly covered with short black hairs, and the white powder on the front of the back plate forms obvious middle stripes and sub-middle stripes. The posterior edge of the small scutellum has a long white bristle, sometimes a black bristle. The feet are like the male, but the coat is short, and the hind femora have no long hair. The abdomen is black and bright, and the base is covered with white powder. The back of the abdomen is finely punctate, covered with short black hairs, and the base and side margins are white.

Body length: ♂ 9 mm, ♀ 9 mm; wing length: ♂ 7 mm, ♀ 7 mm.

This species should belong to *proxima* group, according to the key of Vujic et al (2013), the new species is similar to *C. rufimana* Becker, 1894, but the rear edge of the scutellum of the new species is mainly light-colored mane, and the shape of the upper leaves of the males of the two is different [37].

Main type: ♂, 2019-Ⅴ-6, Hebei Mulan Forest Farm seedling farm (41°43'2.6"N, 118°02'1.4"E, altitude 1078 m), Cai Shengguocai; secondary type: 1♂ 10♀, the same as the main type.

2 Life history studies

C.hebeiensis has one generation per year and overwinters as pupae and larvae. The pupae overwinters in the pine resin outside the bark, and the larvae overwinter in the pine resin at the junction of phloem and xylem inside the bark. The overwintering pupae emerge as adults in May of the next year, and then lay eggs. After a few days, the eggs hatch into larvae, and in July they transfer to the resin block near the bottom of the flow hole to pupate. Overwintering larvae pupate in June of the following year, emerge from June to July, and lay eggs. After hatching, the larvae feed until September, and then enter the overwintering state.

2.1 Eggs

Adults lay eggs 3 to 5 days after eclosion, many grains, and most eggs are laid on the edge of the injured trunk hole. Eggs are granular, 0.8 ~ 1.0 mm, at first light yellow. The egg stage is 6-10 days.

2.2 Larvae

The feeding period of larvae is from May to August, and from September to April of the following year is the overwintering state. The newly hatched larvae are milky white, about 1 mm in size, and the mature larvae are 12-14 mm in length. The larvae are headless and footless rat-tailed maggot-shaped, with scraping-sucking mouthparts, black and curved mouth hooks, and a pair of short breathing tubes at the tail end. The body is cylindrical, the end gradually becomes smaller, the end is round, the protopodia are

underdeveloped, there is no toe hook, and the posterior valve is born on the short tube (Figure 2). After hatching, the larvae directly invade under the bark by wriggling, live between the xylem and phloem, and feed on the resin. As the damage of larvae intensifies, the larch trunk secretes a large amount of rosin, and the excess rosin flows out of the tree (Figure 3-6).

2.3 Pupa

In mid-July, the mature larvae transfer from under the damaged bark to the outside of the bark along with the outflowing pine resin, and prepare to pupate in the pine resin block near the lower part of the resin hole. The mature larvae matured after about 15 days after the transfer. The first ten days of August (before and after the beginning of autumn, when the cosmos is in full bloom) is the peak period of pupation [for larvae derived from overwintering pupae], and the first ten days of September is the peak period of pupation (when the larch begins to shed leaves) [for larvae derived from overwintering larvae]. Pupae overwinter in the resin outside the bark under the flow hole (at this time the fluidity of the pine resin becomes poor and begins to harden). The pupa is 8-10 mm long, 2.5-3.0 mm wide, and brown (Fig. 7-10).

2.4 Adult

In early May of the following year (when the larch male flowers form and needles unfold) with the rapid rise in temperature and sap flow, the pupae begin to eclose into adults. The peak eclosion period is from mid-May to early June, and lasts until mid- to late June. The lifespan of adults is 7-10 days. In the natural state, the number of adults in the forest is small and it is difficult to find them. Adults are rarely active in the forest canopy, mostly below the canopy. In the lab, the adult eclosion time is mostly concentrated at 11:00-13:00, and the adults are more active at 10:00-16:00, and like to fly in the sun.

3 Discussion

The genus *Cheilosia* is widely distributed in various zoogeographic regions of the world, and is the largest genus in the family Syrphidae in the Palearctic region. Although most species are common, little is known about their biology. Dufour[38] reported the first biological information.

Cheilosia species usually lay eggs on the surface of plant stems, leaves, etc. The specific egg-laying position varies from species to species, either at the base of the back of the leaf, or only on the leaves not far from the ground, or on the stem. They can choose one or more host plants. Oviposition is mainly scattered single eggs, or several eggs piled together. The larvae damage the tops of young plant stems, flowers and other organs [39-43]. The morphology of the 3rd-instar larvae of *Cheilosia* is related to the way of feeding, which can be divided into fungivorous, leaf-feeding, stem and root borers and sap and cambium feeders. It is now known that the larvae of some species are herbivorous. The larvae live in the stems and roots of higher plants, or in the leaves. Some species live in the cambium of coniferous trees and feed on sap (resin) [40,44-45].

There are not many reports of *Cheilosia* living in conifer resin. *Cheilosia alaskensis* feeds on tree sap in the cambium of *Tsuga heterophylla*, and its larvae live in resin, while *Cheilosia hoodiana* larvae live in white fir (*Abies concolor*) [46]. Adults of *Cheilosia morio* live in spruce forests, and larvae live in the resin tumors of the spruce bark, causing the spruce to form lipomas [47-49]. *C.hebeiensis* lives in the forests of North China Larch *Larix [gmelini var.] principis-rupprechtii*. The adults lay their eggs on the edge of the injured lip of holes in the trunk of the North China larch, and the larvae feed on turpentine, which is obviously different from other species that have been recorded.

中国黑蚜蝇属一新种记述及其生活史研究

霍科科¹, 蔡胜国², 张楠², 张恩生²

(1. 陕西理工大学生物科学与工程学院, 陕西汉中 723000; 2. 河北省木兰围场国有林场林草有害生物防治检疫站, 河北承德 068450)

摘要 记述采自中国河北省黑蚜蝇属一新种: 河北黑蚜蝇 *Cheilosia hebeiensis* sp.nov.。新种隶属于 *promixa* 种团, 据 Vujić et al (2013) 检索表, 新种近似 *C. rufimana* Becker, 1894, 但新种小盾片后缘主要为浅色鬃状长毛, 且雄性上叶形态不同。新种模式标本保存于陕西理工大学和河北省木兰围场国有林场林草有害生物防治检疫站。给出新种详细的形态描述与主要特征图, 同时记述了该种的生活史。

关键词 蚜蝇科; 黑蚜蝇属; 河北黑蚜蝇; 新种; 形态; 特征; 生活史

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Description of a New Species of *Cheilosia* from China and Its Life Cycle

HUO Ke-ke¹, CAI Sheng-guo², ZHANG Nan² et al (1. School of Biological Sciences & Engineering, Shaanxi University of Technology, Hanzhong, Shaanxi 723000; 2. Forestry and Grassland Pest Control and Quarantine Station, Hebei Mulan Paddock State Forest, Chengde, Hebei 068450)

Abstract The paper described a new species, *Cheilosia hebeiensis* sp.nov., from Hebei Province, China. The new species belonged to the *promixa* group. Based on the key of Vujić et al (2013), the new species was similar to *Cheilosia rufimana* Becker, 1894 in appearance, but differs from the latter by whitish long bristle-like hairs on posterior margin of scutellum and the forms of superior lobe of male. The type specimens were deposited in Shaanxi University of Technology and Forestry and Grassland Pest Control and Quarantine Station, Hebei Mulan Paddock State Forest. The study detailed description and figures of the new species were offered and the life cycle of the species were also reported.

Key words Syrphidae; *Cheilosia*; *Cheilosia hebeiensis* sp.nov.; New species; Morphology; Characteristics; Life cycle

蚜蝇科(Syrphidae)黑蚜蝇属(*Cheilosia*)主要分布在古北区、新北区和东洋区, 新热带区和澳洲区亦有分布, 全世界已知约480种, 其中古北区种类约占70%^[1-15]。从1927年Sack教授记述中国黑蚜蝇属种类开始, 许多学者对中国黑蚜蝇属种类进行了研究, 使中国黑蚜蝇属种类增至约105种^[16-36]。

河北省木兰围场位于河北省围场满族蒙古族自治县境内, 地处浑善达克沙地南缘、滦河上游地区, 属阴山、大兴安岭、燕山余脉的汇接地带, 区域地理坐标为41°35′~42°40′N、116°32′~117°14′E, 海拔750~1 998 m。该地区属半干旱向半湿润过渡区、寒温带向中温带过渡区, 气候为大陆性季风型山地气候, 年平均气温-1.4~4.7℃, 极端最高气温38.9℃, 极端最低气温-42.9℃, 年均降水量380~560 mm, 主要集中在7—9月。2018—2019年对林场区域的森林昆虫进行系统调查, 在华北落叶松林内发现幼虫期生活于华北落叶松树胶中的一种黑蚜蝇, 通过幼虫形态及生活史、蛹和成虫的观察与研究, 确定为一新种。新种模式标本保存于陕西理工大学和河北省木兰围场国有林场林草有害生物防治检疫站。笔者对新种及其相关生物学特性进行了分析。

1 河北黑蚜蝇 *Cheilosia hebeiensis* sp.nov.(图1)

雄性: 复眼密被淡黄毛。头顶隆起, 被暗褐色长毛和白色粉被, 单眼三角呈等边三角形。额略鼓起, 额角较大; 额黑色, 覆白色粉被, 被白色长毛和少量黑毛。新月片黑色, 触角

窝分开。颜宽, 黑色, 具白色绵毛, 中突小, 侧面观超过额突, 略超过口前缘; 眼缘中等宽, 最宽处不大于触角第3节高的一半, 黑色, 有时在复眼下呈暗褐色, 密被白毛和粉被。颊高, 黑色, 被白色长毛和粉被。触角基部2节黑褐色, 第3节近圆形, 黄褐色, 背缘色暗。触角芒黑褐色, 被毛极短。

胸部黑色, 覆白色粉被, 被长度近一致的白色长毛, 胸部背板侧缘无鬃, 小盾片后缘具白色鬃状长毛, 盾下缘缛白色, 长而密; 侧板粉被和毛同背板。后胸腹板被白色长毛。

足黑色, 各足腿节端部及胫节基部暗褐色, 覆白色粉被, 被白色短毛, 前、中足腿节腹面及后侧具白色长毛, 后足腿节前侧具较稀疏的白色长毛, 为短毛的3~4倍, 胫节前侧具暗褐色鬃状长毛, 长度不大于胫节的直径。翅前部略染黄色, 具微刺; 翅脉M₁与R₄₊₅相交呈锐角; 平衡棒黄色, 基部及头部黄褐色。腹部近长椭圆形, 黑色, 被长度一致的白色长毛。

雄性尾器: 黑褐色。第九背板侧面观高大于长。尾须近四边形, 浅黄色, 被淡黄色长毛的暗褐色鬃状长毛。背针突三角状, 顶端宽而钝圆, 背缘中部形成明显的隆脊, 具暗褐色长鬃, 端部内表面具暗褐色短鬃。第九腹板扇状, 腹面后部中部具透明区。上叶狭长, 基部近长方形, 端部向腹面中央扭曲, 呈前后扁平状, 顶端圆形。阳茎端面背面观呈叉状, 两叉之间具膜质的射精突。

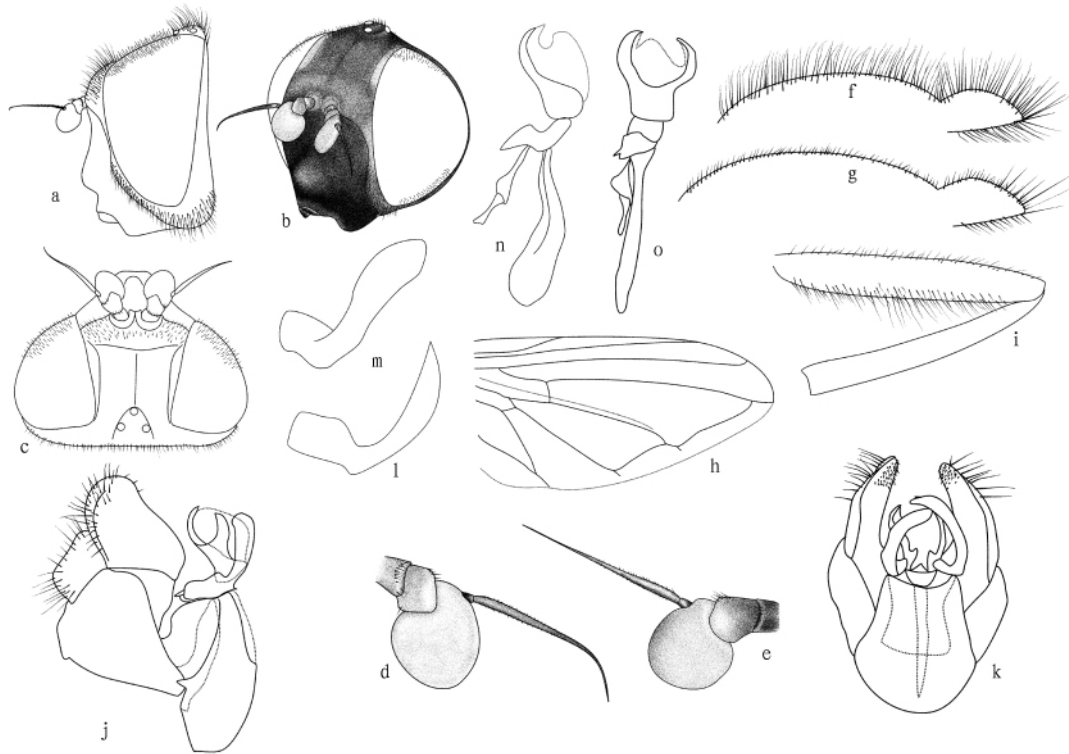
雌性: 被毛明显短于雄性。复眼被短毛。头顶及额较宽, 头顶在复眼后缘处宽约为头宽1/3, 具细刻点, 具3条纵沟, 前部具横沟; 头顶及额黑色, 额中部两侧沿眼缘具黄色狭长斑, 覆近白色粉被, 主要被黑短毛。触角黄褐色, 第3节橙黄色, 大而圆。胸部背面主要被黑色短毛, 背板前部白色粉被形成明显的中条纹和亚中条纹。小盾片后缘具白色长鬃,

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作者简介 霍科科(1962—), 男, 陕西扶风人, 教授, 博士, 从事蚜蝇科昆虫系统进化与发育研究。

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注: a. 雄性头部侧面; b. 雌性头部前侧面; c. 雌性头部背面; d. 雌性触角(内侧); e. 雄性触角(内侧); f. 雄性中胸背板及小盾片侧面; g. 雌性中胸背板及小盾片侧面; h. 翅端半部(雌性); i. 雄性后足腿节与胫节(前面); j. 雄性尾器侧面; k. 雄性尾器腹面; l. 上叶侧面; m. 上叶后侧面; n. 阳茎侧面; o. 阳茎背面

Note: a. Head, lateral view, male; b. Head, anteriolateral view, female; c. Head, dorsal view, female; d. Antenna, inside, female; e. Antenna, inside, male; f. Mesonotum and scutellum, lateral, male; g. Mesonotum and scutellum, lateral, female; h. Half top of wing, female; i. Hind femur and tibiae, anterior view, male; j. Terminalia, lateral, male; k. Terminalia, ventral view, male; l. Superior lobe, lateral view; m. Superior lobe, postrolateral view; n. Aedeagus, lateral view; o. Aedeagus, dorsal view

图1 河北黑蚜蝇

Fig.1 *Cheilosia hebeiensis* sp. nov.

有时黑鬃。足似雄性,但被毛短,后足腿节无长毛。腹部黑亮,基部覆白色粉被。腹部背面具细刻点,被黑色短毛,基部及侧缘具白毛。

体长: ♂ 9 mm, ♀ 9 mm; 翅长: ♂ 7 mm, ♀ 7 mm。

本种应属于 *promixa* 种团,据 Vujic et al (2013) 检索表,新种近似 *C. rufimana* Becker, 1894,但新种小盾片后缘主要为浅色鬃,且二者雄性上叶形态不同^[37]。

正模: ♂, 2019-V-6, 河北木兰林场种苗场(41°43'2.6" N、118°02'1.4"E, 海拔 1 078 m), 蔡胜国采; 副模: 1 ♂ 10 ♀, 同正模。

2 生活史研究

河北黑蚜蝇 1 年 1 代,以蛹和幼虫 2 种虫态越冬,其中蛹在树皮外的松脂内越冬,幼虫在树皮内韧皮部与木质部交界处松脂内越冬。越冬蛹翌年 5 月羽化为成虫,随后产卵,经过短暂几天卵孵化为幼虫,7 月转移至流脂孔下方附近松脂块内化蛹。越冬幼虫翌年 6 月化蛹,6—7 月羽化、产卵,幼虫孵化后取食至 9 月,随即进入越冬状态。

2.1 卵 成虫羽化后 3~5 d 产卵,多粒,产卵位置多在树干受伤流脂孔边缘。卵为粒状,0.8~1.0 mm,初产淡黄色。卵期 6~10 d。

2.2 幼虫 幼虫取食期 5—8 月,9 月—翌年 4 月为越冬态。初孵幼虫乳白色,大小 1 mm 左右,老熟幼虫体长 12~14 mm。幼虫为无头无足鼠尾蛆型,具有刮吸式口器,口钩黑色、弯曲,尾端具有一对短的呼吸管。体圆筒形,端部略逐渐变小,末端圆,原足不发达,无趾钩,后气门着生在短管上(图 2)。

幼虫孵化后通过蠕虫直接侵入树皮,生活于木质部和韧皮部之间,以树脂为食。随着幼虫危害加剧落叶松树分泌大量松脂,过量松脂流出树体外(图 3~6)。

2.3 蛹 7 月中旬始见老熟幼虫从其危害的树皮外随流出的松脂转移到树皮外,在流脂孔下方附近松脂块中准备化蛹,流出后经 15 d 左右老熟幼虫化蛹,8 月上旬(立秋季节前后,波斯菊盛花)为化蛹始盛期,9 月上旬为化蛹盛期(落叶松开始落叶),蛹在流孔下方的树皮外松脂内(此时松脂流动性变差开始变硬)越冬。围蛹长 8~10 mm,粗 2.5~3.0 mm,棕褐色(图 7~10)。

2.4 成虫期 翌年 5 月上旬(落叶松雄花成形,针叶展叶期)随着气温快速升高,树脂液流动,蛹开始羽化为成虫,5 月中旬—6 月上旬为羽化盛期,羽化期持续至 6 月中、下旬。成虫寿命 7~10 d,自然状态下林间成虫量少,不易发现。成虫很少在林冠层活动,多在树冠以下位置。室内观察,成虫羽



图 2 河北黑蚜蝇 3 龄幼虫背面整体

Fig.2 The whole back of the third instar larva of *Cheilosia hebeiensis* sp.nov., dorsal view



图 3 树干松脂内低龄幼虫

Fig.3 The first instar larva in turpentine



图 4 树干松脂内幼虫

Fig.4 Larva in turpentine

化时间多集中在 11:00—13:00,成虫在 10:00—16:00 较活跃,喜欢在阳光下飞翔。

3 讨论

黑蚜蝇属广布于世界各动物地理区域,为古北区蚜蝇科



图 5 树干松脂内老龄幼虫

Fig.5 Old larvae in turpentine

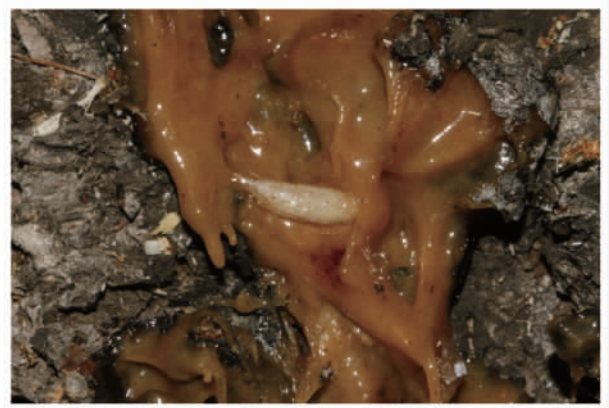


图 6 树干外被流脂包裹幼虫

Fig.6 Larva embedded in flowing turpentine outside the trunk



图 7 越冬前蛹

Fig.7 Pupa before the winter

中最大的属,虽然大多数种类都很常见,但对他们的生物学习性了解甚少。Dufour^[38]首次报道黑蚜蝇的生物学习性。

黑蚜蝇属种类通常产卵于植物茎、叶等表面,具体的产卵位置因种而异,或产于叶背面基部,或只在离地面不远的叶片上,或产于茎干上;选择的寄主植物 1 种或几种不等;产卵方式以单粒散产为主,或数个卵堆在一块。幼虫为害植物幼茎顶端、花等器官^[39-43]。黑蚜蝇 3 龄幼虫形态与取食方式有关,可分为菌食性、叶食性、茎根钻蛀性和树汁及形成层取



图8 越冬后蛹

Fig.8 Pupa after the winter



图9 初化蛹

Fig.9 Pupa after pupation

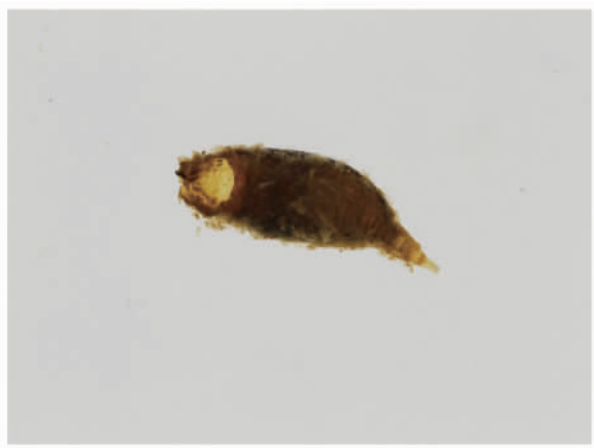


图10 羽化后的蛹壳

Fig.10 Pupal shell after emergence

食者。现已知黑蚜蝇属部分种类的幼虫为植食性,幼虫在高等植物的茎干及根中钻蛀生活,或在叶中钻蛀生活,部分种类的幼虫为腐食性或菌食性,以真菌的子实体为食,还有一些种类生活于针叶树的形成层,取食树脂(树脂)^[40,44-45]。

关于黑蚜蝇生活在针叶树脂中的报道并不多。*Cheilosia alaskensis* 在异叶铁杉(*Tsuga heterophylla*) 形成层取食树

汁,幼虫生活于松香中,而 *Cheilosia hoodiana* 幼虫生活于白冷杉(*Abies concolor*)^[46]。*Cheilosia morio* 成虫生活于云杉林,幼虫在云杉树皮的树脂瘤上生活,引起云杉形成脂瘤^[47-49]。河北黑蚜蝇生活于华北落叶松(*Larix principis-rupprechtii*) 林中,成虫产卵于华北落叶松树干受伤流脂孔边缘,且幼虫以松脂为食,明显不同于已记录的其他种类。

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