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# First Record, Prevalent Hosts, Biological and Managing Attributes of False Chinch Bug (Hemiptera: Lygaeidae) Injuring *Helianthus annuus*, Brassica and *Chenopodium* from Punjab, Pakistan

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**Abstract**

A survey of insect pests during years 2011 to 2017 in Punjab Pakistan districts of Faisalabad Sahiwal, Vehari, Lodhran and Multan has provided a new record of false chinch bug (Hemiptera- Lygaeidae, Subfamily: Orsillinae) or Nysius caledoniae Distant. *N. caledoniae* was remarked infesting majorly *Brassica oleracea*, *B. napus* and *B. rapa*; *Chenopodium album*, *C. murale* and *Helianthus annuus* crops in various urban, peri-urban and rural areas especially Faisalabad division of Punjab province. This is the very first report of an individual affiliate of genus *Nysius* with polyphagy from foremost cropping plains zones in Pakistan, but presence of multiple forms depicted a complex blend possessing some other *Nysius* spp. too. An infusive and primary description of ID keys, prevalence, biological cycles, injuries, host ranges-minor to majors and pest-controlling measures have been presented.

**Keywords:** New report; Pest; Distribution; *Nysius* genera keys; Oil seed crops

## Introduction

During the years survey of 2011 to 2017, a drastic infestation percent and damages were found due to false chinch bugs on crops especially sunflower [1-4] along with Brassicaceae and Chenopodiaceae especially *Chenopodium album, C. murale* or commonly called *bathu* and *karund* [5,3]. This is the new first record of a false chinch member infesting heavily from Pakistan comprising major cropping zones. Previously this was wrongly nominated and misunderstood as seed bugs owing to several matching features of phenotypic aspects as well as gregarious feeding natures [6,7,4]. But a detailed survey exploration enabled to make it on right footings following its first record on a number of important botanical families of Chenopodiaceae, Compositeae and Brassicaceae [1,8]. Until present days it was remained for almost full negligence and no particular efforts were made to incorporate novel pest nature and thus integrate for full pest control status, host ranges and control measures [9,4,10].

The original and first ID elucidations, as major pest of *Nysius* [6] had been given from by Kansas by Howard [11] were employed for biological aspects and identity recognitions of false chinch bugs. For an overview descriptions, its status was determined as Order: Hemiptera, Suborder: Heteroptera, Infraorder: Pentatomomorpha, Superfamily: Lygaeoidea, Family: Lygaeidae, Subfamily: Orsillinae, Tribe: Nysiini, Genus: *Nysius*. Lygaeidae encompass about 3000 bugs taxonomically with inclusion of genus *Nysius* [12,2,8]. Nysius caledoniae is a minute insect nourishing on phloem contents, bearing a number of generations in fecundity seasonal cycles [6,3,9,10]. This remains inactive post-over of main hosts especially in winters under litters, garbage or field crop residues. Globally its preference to important members *Brassica*, *Compositeae* and *Chenopodium* have been reported [6,5,2]. The major perpetrated injuries were accompanying their gregarious feeding habits leading to permanent plant wilt and kill [13] with individual feeder has not yet recorded to post pivotal damages [1,7,14]. False chinch bugs have been included in key pest category for Brassica napus cultivated in Colorado making pivotal crop losses with major impacts on seed and pod formative phases in brassica and in achene formations in sun flowers are recognizable [6,13,3]. All the recorded Nysius caledoniae are most important economical and cash crops pests not nationally but also on internationals fronts [13,8,10]. Hence, this record is not only helpful to remove previous misconceptions, but also to devise new pest integrated control planes, for newer insects and pathogens, incorporating both cultural and chemical prospects for defensible crop yields [15,10,14].

## Materials and Methods

Bug samples, infesting *Brassica oleracea, B. napus, B. rapa, C. album, C. murale* and *H. annuus* crops were swept from April 2011 to September 2017 via standard collection nets and all the insects were immediately killed via 'insect poison bottle' comprising potassium cyanide accompanied by plaster of Paris containments. The collections were accomplished in Punjab provincial districts viz. Faisalabad, Sahiwal, Vehari, Lodhran and Multan. The chief collection site was division Faisalabad (LATITUDE=31° 26' N, LONGITUDE=73°-6' E,

ALTITUDE =184.4 m). Then, the killed specimen were preserved in 90 to 95% ethyl alcohol and deposited in the established laboratory of Entomological Research Institute, AARI, Faisalabad. Identification and recognitions were executed followed by the remarks of [12].

## Results

### Identity remarks for Lygaeidae and Nysius caledoniae

Family Lygaeidae is comprehensively described for antennal segments branching to 4 (Figures 1-3) emerging from lower side of head and presence of ocelli (Figure 3). On legs, tarsus has 3 conspicuous segmentation with a cushioning pad on the lower terminal side of each claw and anterior enlarged femur. Forewings membranes are conspicuous with 3-5 microscopic veins with multivariate colors, shape and sizes (Figures 1 and 2) [16]. The specimens were identified from presented characters [12]. Adults were minute, creamy grey insects with their habits of reaching to extreme numbers in just few times. Body length male=4.0 to 4.7 mm female=4.30 to 5.1 mm, length of antennae male=2.3-2.5 mm 2.40 to 2.61 mm when full extended (Figures 1-7). A clear difference in the abdominal terminal ventral sides of both female (Figure 8a) and male (Figure 8b). Pronotum 0.89 mm in male and female=0.96 mm, scutellum male=0.61 mm and female=0.70 mm (Figures 1 and 2). Ashy-grey color body and head greyish brown with longitudinal broader band of orange color and eyes of crimson to brown color. Antennae, being four segmented were varyingly differing with first one yellow, latter were brown and apical one dark. Pronotum was greyish black fetching transverse basio-anterior strip. Scutellum was ridging with yellowish brown to yellow colors with minute spotting of brownish black dots on pronotum, head and scutellum and cephalothoraxes (Figure 3). Hemelytra showing front wing greyish brown, with two spots on inner claval marginal area and membrane appearing hyaline. Legs were greyish brown, femur with brownish dotting tibial segments were brown at apical and basal sides (Figure 5) 0.1 mm tibial length, tarsomeres were brown. In lower body surface of male, ostiular peritreme was white and pink at posterior margins. Coxal sheath white; and left-over under-sheath darker brown. Abdomen, crimson brown, showing band running longitudinally of pale coloration. Female with similar formative configurations with higher abdominal pale color. Structure, overall macropterous (Figures 1 and 2), margin at costal region were more arcing. Lengthy straight and partial-straight setae together with fine pubescence were occurring on hemelytral, pronotal and scutellum areas. Minute piercings near clypeus more often producing V-shape furrow was existed. Comparatively flat or levelled sunke dorsal side immediately lowering to eyes with labium getting closer to hinder coxal part. Scutellum apical part up-rounded and crooked. Complete double lines of perforation, one on every sideway, setae together with fine pubescence occurring on hemelytral following claval suture. Paramere (Figure 6) extended, not immediately arcuate.

Nymphal coloration, 5$^{th}$ instar, length 3.50 to 3.61 mm, (Figure 4) similar to adults but abdominal region crimson red. Varyingly off-yellow or crimson stripes existing on anterior 2/3 of wing pads, head and pronotum part. Emerging darker wing pads and antennae coverings black (Figure 4). Pale wider band present on lower head surface. Pronotum frontal boundary pale yellow. Forewing pad apical side often-dark brown with hind wing pads visibly pale yellow. Abdominal dorsum with pale yellow acnes. Femoral side black to dark crimson with apical tips yellowish and brown tibia (Figure 5). Male gentle taken out organs were oval with lobed formation depicting internal assemblies (Figure 7). Nysius caledoniae is distinctive, contrasting to others members genus *Nysius* (specially e.g. N. huttoni) with characteristic features of larger body 4.0 to 5.1 mm in N. caledoniae comparing to 2.35 to 4.35 mm, antennal apical segments much yellow, vertex flat or levelled. Head dorsum with longitudinal ridges and apparently distinguishing macropterous formation, clearly visible, with embiolar basal region more parallel and lengthy; Scutellum crooked up-rounded and less steeply arcuate (Figure 6). Similarly, nymphal 5$^{th}$ instar are also prominent on the basis of largerbody size, greater head breadth and varyingly yellow to crimson brownish bands on pronotum region and immature wing pad areas (Figure 4).

**Life stages, development, biological cycles and damages:** Their feeding plants are of variable categories. It has ability to produce multiple generations/year. Hibernations are under mulch overs of litters, plant debris and crop remnants, usually in adult forms [6,1,4]. Eggs are about, in length 1.5 mm and in width 0.4 mm, with coloration variation of pinkish transparent to cream white [6,17]. The oviposition localities are may be porous soil, debris places, or most preferably petals crevices on floral regions. Nymphal stages are 5 with color similarity of off-grey color and reddish to brown abdomens [17]. All the mature to immature insect phases can be found impairing the plant tissues, simultaneously. It's a polyphagous insect but most preferential plant families are Brassicaceae, Chenopodiaceae and Compositeae [6,1,2,9].


**Figure 1**: Male=4.0 to 4.7 mm body length.

Damaging symptoms are fundamentally inflicted while sucking the phloem sap. A clear chlorosis and leaf yellowing with concurrent leaf dryness is observed. Damage is least when a single feeder is there but plant wilting with ultimate plant killing is observed when gregarious feeding groups are found on plant parts, under lethal infestations [4,17,10].

### Distribution and host range in Punjab, Pakistan

On global scale there are about 100 species of the genus *Nysius* [17], found to be associated with plant phagous behaviors and only 6 reached the economic pest status on varying important crops of *Brassica, Helianthus and Chenopdum* [1,18,17]. *N. caledoniae* and *N. caledoniae*, are of wider prevalence from America, Australia and Asia

[12,13,4,17]. During the whole survey and collection season, the developmental *Nysius* stages were found on the plant families in whole regions. Most infestations and hot-spot area were found in division of Faisalabad, Punjab (LATITUDE=31° 26' N, LONGITUDE=73°-6' E, ALTITUDE=184.4 m).


**Figure 2**: Female=4.30 to 5.1 mm.

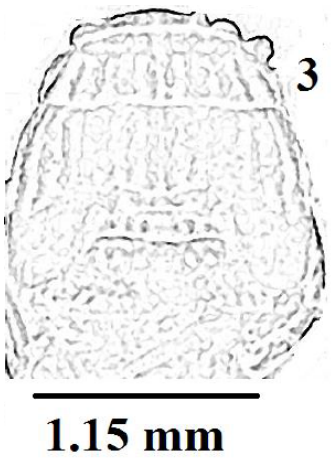


**Figure 3**: Cephalothoraxes region of nymphal instar with conscious markings.

In areas, of aforementioned with district Sahiwal, Vehari, Lodhran, Bahawalpur and Multan. The reported host ranges were cabbage, mustard, radish, cotton, flax, sunflower, tobacco, and major Chenopodiaceae members *bathu* and *karund* showing about 70 to 90 percent infestation rates [3,4].


**Figure 4**: Nymphal instar with emerging wing pads and black antennal covering.

Quinoa- a newly introduced potentially economic and nutritious cereal supplemental crop, in Pakistan is also under its threat Notwithstanding its comparatively extensive host range, cereal crops were not found to be much favorite, and impairment damages were more on oil seeding plants with much frequent occurrence [3,7,14].


**Figure 5**: Tibial structure-terminal 0.1 mm measured length.

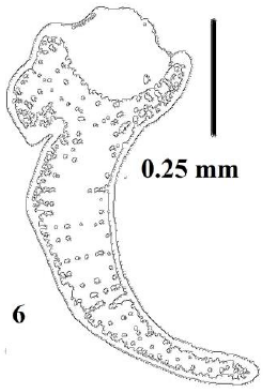


**Figure 6**: Paramere structure seen dorsal side turned marginally.


**Figure 7**: Male gentle extracted organs-oval with lobed formation with 0.1 mm arc oval side measures.

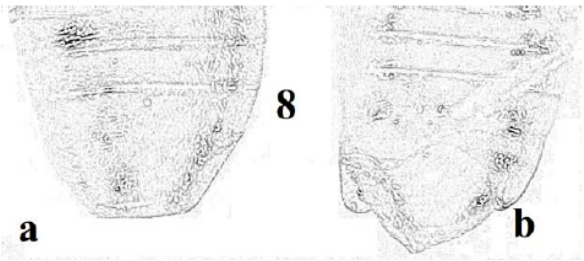


**Figure 8**: Abdominal terminal ventral sides of female (a) and male (b).

### Keys to *Nysius* genus- designated species complex-Pakistan

- Complete double lines of perforation, one on every sideway, both setae-straight and partial straight together with fine pubescence occurring on hemelytral following claval suture----------3
- Complete single line of perforation, with one and only one setae-straight and partial straight together with fine pubescence occurring on hemelytral following claval suture ----------5
- Scutellum apical part up-rounded and crooked (Figure 2), vertex flat or levelled, sunken dorsal side immediately lowering to eyes, paramere (Figure 6) extended, not immediately arcuate----------caledoniae
- Scutellum apical part knobbed and flat, vertex U-shaped, emerged dorsal side immediately lowering to eyes, Paramere extended, immediately arcuate----------huttoni
- *Nysius* wings no fine pubescent but possessing setae-straight and partial straight----------convexus
- *Nysius* wings getting fine pubescent but possessing setae- straight and partial straight ----------iliputanus

### Managing and control prospects

As already mentioned that most of farmers as well as researchers were unaware of its distinguishing existence and misunderstanding it with seed bugs [3,7,4], henceforth no proper individual measures were taken in these areas. Among control tactics, the chemical measures were extensively adopted for insecticidal control comprising imidacloprid, acetamiprid, dimethoate, profenophos and pyriproxifin [7,9]. No proper biological control was prevalent except the natural ones of neuropterans lace wings [19,4] and some of efficient Coccinelids working for nymphs only [19]. No particular hymenopterans or bug parasitoid was noticed. Cultural practices of weeds removal, irrigation scheduling, fertilizers and cropping intensities were as usual. However, alternate crop systems or crop rotations were appeared to be of significant values [20]. Similarly, proper irrigation management can make plants to recover and augment bug injuries.

## Discussion

Insects right identifications are one of the important feature to devise control measures based on the specified biology, damages and host ranges. A survey was performed to determine the insects' status along with prevalence of new species from 2011 to 2017 covering different areas. Nysius caledoniae infestations were reported globally [6,2,8] not only in a single area but from varying regions damaging important oil seed crops of brassica, sunflower and cereals of Chenopodiaceae [8,10]. *Nysius* status as a key pest have also been confirmed [6]. False chinch bug or *N. caledoniae* were previously misunderstood among common seed bugs and hence farmers were not able to properly manage permitting its establishment to lethal ranks [21,19,4].

Being a diverse plant host feeder, its survival and prolificacy successes are protuberant. Important plant families of Brassicaceae, Compositeae and Chenopodiaceae are under its infesting menace [6,5,2] (Demirel & Cranshaw 2005, Du Plessis et al., Larivière and Larochelle 2014). Progressive research on bio-ecology and pest status is essential in order to have a workable management plan. The new record of false chinch bug rather than previously misunderstood seed bug, will be highly assistive in pest deterring and reduction points with loss minimizing aspects leading to sustained cropping yields.

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